REPUBLIC OF KENYA

MINISTRY OF WATER & SANITATION AND IRRIGATION

NORTHERN WATER WORKS DEVELOPMENT AGENCY

TENDER DOCUMENT FOR CONSTRUCTION OF LESOIT WATER DAM PROJECT:-

TENDER NO. NWWDA/CW/T/015/2022-2023

VOLUME I

BID DOCUMENT

PROCURING ENTITY

NORTHERN WATER WORKS DEVELOPMENT AGENCY
Maji House, Kismayu Road
PO Box 495 – 70100 Garissa, Kenya
Tel: +254-46-2103598/3797
E-mail: info@nwwda.go.ke

ISSUE DATE: ……..30th May 2023…

INVITATION TO TENDER

Open National Tender for Construction of :-
LESOIT WATER DAM PROJECT:-

1. The **Northern Water Works Development Agency** invites sealed tenders for the Construction of **LESOIT DAM WATER PROJECT**

2. Tendering will be conducted under open competitive tendering method using a standardized tender document and is open to all qualified and interested **Tenderers**.

3. Qualified and interested tenderers may obtain further information and inspect the Tender Documents during office hours **0900 to 1700 hours** at the address given below. Tender documents may be viewed and/or downloaded from the website www.nwwda.go.ke or www.tender.go.ke free of charge

4. Alternatively, a complete set of tender documents may be purchased or obtained by interested tenders upon payment of a non- refundable fees of Kshs 1,000.00 in cash or Banker's Cheque and payable to the address given below. Tender documents obtained electronically will be free of charge.

5. Tender documents may be viewed and downloaded for free from the website www.nwwda.go.ke . Tenderers who download the tender document must forward their particulars immediately to *info@nwwda.go.ke* to facilitate any further clarification or addendum.

6. Tenders shall be quoted be in Kenya Shillings and shall include all taxes. Tenders shall remain valid for 90 days from the date of opening of tenders.

7. All Tenders must be accompanied by a "tender Security" of **Kshs 1,200,000/=** (Bank Guarantee)

8. The Tenderer shall chronologically serialize all pages of the tender documents submitted.

9. Completed tenders must be delivered to the address below on or before **14th June 2023 at 11.00 am.** *Electronic* Tenders *will* **not** be permitted.

10. Tenders will be opened on **14th June 2023** at 11.30 am immediately after the deadline date and time specified above or any dead line date and time specified later. Tenders will be publicly opened in the presence of the Tenderers' designated representatives who choose to attend at the address below.

11. Late tenders will be rejected.

12. The addresses referred to above are:

Chief Executive Officer

Northern Water Works Development Agency

Maji House, Kismayu Road, Ground Floor Room A3

PO Box 495 – 70100 Garissa, Kenya

Tel: +254-46-2103598/3797

E-mail: info@nwwda.go.ke

PART 1 - TENDERING PROCEDURES

SECTION I: INSTRUCTIONS TO TENDERERS

A General Provisions

1. Scope of Tender

1.1 The Procuring Entity as defined in the Appendix to Conditions of Contract invites tenders for Works Contract as described in the tender documents. The name, identification, and number of lots (contracts) of this Tender Document are **specified in the TDS.**

2. Fraud and Corruption

2.1 The Procuring Entity requires compliance with the provisions of the Public Procurement and Asset Disposal Act, 2015, Section 62 "Declaration not to engage in corruption". The tender submitted by a person shall include a declaration that the person shall not engage in any corrupt or fraudulent practice and a declaration that the person or his or her sub-contractors are not debarred from participating in public procurement proceedings.

2.2 The Procuring Entity requires compliance with the provisions of the Competition Act 2010, regarding collusive practices in contracting. Any tenderer found to have engaged in collusive conduct shall be disqualified and criminal and/or civil sanctions may be imposed. To this effect, Tenders shall be required to complete and sign the "Certificate of Independent Tender Determination" annexed to the Form of Tender.

2.3 Unfair Competitive Advantage - Fairness and transparency in the tender process require that the firms or their Affiliates competing for a specific assignment do not derive a competitive advantage from having provided consulting services related to this tender. To that end, the Procuring Entity shall indicate in the **Data Sheet** and make available to all the firms together with this tender document all information that would in that respect give such firm any unfair competitive advantage over competing firms.

2.4 Unfair Competitive Advantage -Fairness and transparency in the tender process require that the Firms or their Affiliates competing for a specific assignment do not derive a competitive advantage from having provided consulting services related to this tender being tendered for. The Procuring Entity shall indicate in the **TDS** firms (if any) that provided consulting services for the contract being tendered for. The Procuring Entity shall check whether the owners or controllers of the Tenderer are same as those that provided consulting services. The Procuring Entity shall, upon request, make available to any tenderer information that would give such firm unfair competitive advantage over competing firms.

3. Eligible Tenderers

3.1 A Tenderer may be a firm that is a private entity, a state-owned enterprise or institution subject to ITT 3.7 or any combination of such entities in the form of a joint venture (JV) under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. Public employees and their close relatives *(spouses, children, brothers, sisters and uncles and aunts)* are not eligible to participate in the tender. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the tendering process and, in the event the JV is awarded the Contract, during contract execution. The maximum number of JV members shall be specified in the **TDS.**

3.2 Public Officers of the Procuring Entity, their Spouses, Child, Parent, Brothers or Sister. Child, Parent, Brother or Sister of a Spouse, their business associates or agents and firms/organizations in which they have a substantial or controlling interest shall not be eligible to tender or be awarded a contract. Public Officers are also not allowed to participate in any procurement proceedings.

3.3 A Tenderer shall not have a conflict of interest. Any tenderer found to have a conflict of interest shall be disqualified. A tenderer may be considered to have a conflict of interest for the purpose of this tendering process, if the tenderer:

a) Directly or indirectly controls, is controlled by or is under common control with another tenderer; or

b) Receives or has received any direct or indirect subsidy from another tenderer; or

c) Has the same legal representative as another tenderer; or

d) Has a relationship with another tenderer, directly or through common third parties, that puts it in a position to influence the tender of another tenderer, or influence the decisions of the Procuring Entity regarding this

tendering process; or

e) Any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the tender; or

f) any of its affiliates has been hired (or is proposed to be hired) by the Procuring Entity as Engineer for the Contract implementation; or

g) Would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the contract specified in this Tender Document or

h) Has a close business or family relationship with a professional staff of the Procuring Entity who:

i) are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract; or

ii) would be involved in the implementation or supervision of such Contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract.

3.4 A tenderer shall not be involved in corrupt, coercive, obstructive, collusive or fraudulent practice. A tenderer that is proven to have been involved any of these practices shall be automatically disqualified.

3.5 A Tenderer (either individually or as a JV member) shall not participate in more than one Tender, except for permitted alternative tenders. This includes participation as a subcontractor in other Tenders. Such participation shall result in the disqualification of all Tenders in which the firm is involved. A firm that is not a tenderer or a JV member may participate as a subcontractor in more than one tender. Members of a joint venture may not also make an individual tender, be a subcontractor in a separate tender or be part of another joint venture for the purposes of the same Tender.

3.6 A Tenderer may have the nationality of any country, subject to the restrictions pursuant to ITT 4.8.A Tenderer shall be deemed to have the nationality of a country if the Tenderer is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or sub-consultants for any part of the Contract including related Services.

3.7 Tenderer that has been debarred from participating in public procurement shall be ineligible to tender or be awarded a contract. The list of debarred firms and individuals is available from the website of PPRA www.ppra.go.ke.

3.8 Tenderers that are state-owned enterprises or institutions may be eligible to compete and be awarded a Contract(s) only if they are accredited by PPRA to be (i) a legal public entity of the state Government and/or public administration, (ii) financially autonomous and not receiving any significant subsidies or budget support from any public entity or Government, and (iii) operating under commercial law and vested with legal rights and liabilities similar to any commercial enterprise to enable it compete with firms in the private sector on an equal basis.

3.9 A Firms and individuals may be ineligible if their countries of origin (a) as a matter of law or official regulations, Kenya prohibits commercial relations with that country, or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Kenya prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country. A tenderer shall provide such documentary evidence of eligibility satisfactory to the Procuring Entity, as the Procuring Entity shall reasonably request.

3.10 Foreign tenderers are required to source at least forty (40%) percent of their contract inputs (in supplies, subcontracts and labor) from national suppliers and contractors. To this end, a foreign tenderer shall provide in its tender documentary evidence that this requirement is met. Foreign tenderers not meeting this criterion will be automatically disqualified. Information required to enable the Procuring Entity determine if this condition is met shall be provided in for this purpose is be provided in *"SECTION III - EVALUATION AND QUALIFICATION CRITERIA, Item 9".*

3.11 Pursuant to the eligibility requirements of ITT 4.10, a tender is considered a foreign tenderer, if the tenderer is not registered in Kenya or if the tenderer is registered in Kenya and has less than 51 percent ownership by Kenyan

Citizens. JVs are considered as foreign tenderers if the individual member firms are not registered in Kenya or if are registered in Kenya and have less than 51 percent ownership by Kenyan citizens. The JV shall not subcontract to foreign firms more than 10 percent of the contract price, excluding provisional sums.

3.12 The National Construction Authority Act of Kenya requires that all local and foreign contractors be registered with the National Construction Authority and be issued with a Registration Certificate before they can undertake any construction works in Kenya. Registration shall not be a condition for tender, but it shall be a condition of contract award and signature. A selected tenderer shall be given opportunity to register before such award and signature of contract. Application for registration with National Construction Authority may be accessed from the website www.nca.go.ke.

3.13 The Competition Act of Kenya requires that firms wishing to tender as Joint Venture undertakings which may prevent, distort or lessen competition in provision of services are prohibited unless they are exempt in accordance with the provisions of Section 25 of the Competition Act, 2010. JVs will be required to seek for exemption from the Competition Authority. Exemption shall not be a condition for tender, but it shall be a condition of contract award and signature. A JV tenderer shall be given opportunity to seek such exemption as a condition of award and signature of contract. Application for exemption from the Competition Authority of Kenya may be accessed from the website www.cak.go.ke

3.14 A Kenyan tenderer shall provide evidence of having fulfilled his/her tax obligations by producing a valid tax clearance certificate or tax exemption certificate issued by the Kenya Revenue Authority.

4. Eligible Goods, Equipment, and Services

4.1 Goods, equipment and services to be supplied under the Contract may have their origin in any country that is not eligible under ITT 3.9. At the Procuring Entity's request, Tenderers may be required to provide evidence of the origin of Goods, equipment and services.

4.2 Any goods, works and production processes with characteristics that have been declared by the relevant national environmental protection agency or by other competent authority as harmful to human beings and to the environment shall not be eligible for procurement.

5. Tenderer's Responsibilities

5.1 The tenderer shall bear all costs associated with the preparation and submission of his/her tender, and the Procuring Entity will in no case be responsible or liable for those costs.

5.2 The tenderer, at the tenderer's own responsibility and risk, is encouraged to visit and examine the Site of the Works and its surroundings, and obtain all information that may be necessary for preparing the tender and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the tenderer's own expense.

5.3 The Tenderer and any of its personnel or agents will be granted permission by the Procuring Entity to enter upon its premises and lands for the purpose of such visit. The Tenderer shall indemnify the Procuring Entity against all liability arising from death or personal injury, loss of or damage to property, and any other losses and expenses incurred as a result of the inspection.

5.4 The tenderer shall provide in the Form of Tender and Qualification Information, a preliminary description of the proposed work method and schedule, including charts, as necessary or required.

B. Contents of Tender Documents

6. Sections of Tender Document

6.1 The tender document consists of Parts 1, 2, and 3, which includes all the sections specified below, and which should be read in conjunction with any Addenda issued in accordance with ITT 8.

PART 1 Tendering Procedures

i) Section I - Instructions to Tenderers (ITT)
ii) Section II - Tender Data Sheet (TDS)
iii) Section III - Evaluation and Qualification Criteria
iv) Section IV - Tendering Forms

PART 2 Works Requirements

i) Section V - Drawings
ii) Section VI - Specifications
iii) Section VII - Bills of Quantities

PART 3 Conditions of Contract and Contract Forms

i) Section VIII - General Conditions of Contract (GCC)
ii) Section IX - Special Conditions of Contract (SC)
iii) Section X - Contract Forms

6.2 The Invitation to Tender Document (ITT) issued by the Procuring Entity is not part of the Contract documents.

6.3 Unless obtained directly from the Procuring Entity, the Procuring Entity is not responsible for the completeness of the Tender document, responses to requests for clarification, the minutes of the pre-Tender meeting (if any), or Addenda to the Tender document in accordance with ITT 8. In case of any contradiction, documents obtained directly from the Procuring Entity shall prevail.

The Tenderer is expected to examine all instructions, forms, terms, and specifications in the Tender Document and to furnish with its Tender all information and documentation as is required by the Tender document.

7. Site Visit

7.1 The Tenderer, at the Tenderer's own responsibility and risk, is encouraged to visit and examine and inspect the Site of the Required Services and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for the Services. The costs of visiting the Site shall be at the Tenderer's own expense.

8. Pre-Tender Meeting

8.1 The Procuring Entity shall specify in the TDS if a pre-tender meeting will be held, when and where. The Procuring Entity shall also specify in the TDS if a pre-arranged pretender site visit will be held and when. The Tenderer's designated representative is invited to attend a pre-arranged pretender visit of the site of the works. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

8.2 The Tenderer is requested to submit any questions in writing, to reach the Procuring Entity not later than the period specified in the TDS before the meeting.

8.3 Minutes of the pre-Tender meeting and the pre-arranged pretender site visit of the site of the works, if applicable, including the text of the questions asked by Tenderers and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Tenderers who have acquired the Tender Documents in accordance with ITT 6.3. Minutes shall not identify the source of the questions asked.

8.4 The Procuring Entity shall also promptly publish anonym zed (*no names*) Minutes of the pre-Tender meeting and the pre-arranged pretender visit of the site of the works at the web page identified in the TDS. Any modification to the Tender Documents that may become necessary as a result of the pre-tender meeting and the pre-arranged pretender site visit, shall be made by the Procuring Entity exclusively through the issue of an Addendum pursuant to ITT 8 and not through the minutes of the pre-Tender meeting. Nonattendance at the pre-Tender meeting will not be a cause for disqualification of a Tenderer.

9. Clarification and amendments of Tender Documents

9.1 A Tenderer requiring any clarification of the Tender Document shall contact the Procuring Entity in writing at the Procuring Entity's address specified in the **TDS** or raise its enquiries during the pre-Tender meeting and the pre- arranged pretender visit of the site of the works if provided for in accordance with ITT 8.4. The Procuring Entity will respond in writing to any request for clarification, provided that such request is received no later than the period specified in the **TDS** prior to the deadline for

submission of tenders. The Procuring Entity shall forward copies of its response to all tenderers who have acquired the Tender Documents in accordance with ITT 6.3, including a description of the inquiry but without identifying its source. If specified in the **TDS**, the Procuring Entity shall also promptly publish its response at the web page identified in the **TDS**. Should the clarification result in changes to the essential elements of the Tender Documents, the Procuring Entity shall amend the Tender Documents appropriately following the procedure under ITT 8.4.

10. Amendment of Tendering Document

10.1 At any time prior to the deadline for submission of Tenders, the Procuring Entity may amend the Tendering document by issuing addenda.

10.2 Any addendum issued shall be part of the tendering document and shall be communicated in writing to all who have obtained the tendering document from the Procuring Entity in accordance with ITT 6.3. The Procuring Entity shall also promptly publish the addendum on the Procuring Entity's web page in accordance with ITT 8.4.

10.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their Tenders, the Procuring Entity shall extend, as necessary, the deadline for submission of Tenders, in accordance with ITT 25.2 below**.**

C. Preparation of Tenders

11. Cost of Tendering

11.1 The Tenderer shall bear all costs associated with the preparation and submission of its Tender, and the Procuring Entity shall not be responsible or liable for those costs, regardless of the conduct or outcome of the tendering process.

12. Language of Tender

12.1 The Tender, as well as all correspondence and documents relating to the tender exchanged by the tenderer and the Procuring Entity, shall be written in the English Language. Supporting documents and printed literature that are part of the Tender may be in another language provided they are accompanied by an accurate and notarized translation of the relevant passages into the English Language, in which case, for purposes of interpretation of the Tender, such translation shall govern.

13. Documents Comprising the Tender

13.1 The Tender shall comprise the following:

a) Form of Tender prepared in accordance with ITT 14;
b) Schedules including priced Bill of Quantities, completed in accordance with ITT 14 and ITT 16;
c) Tender Security or Tender-Securing Declaration, in accordance with ITT 21.1;
d) Alternative Tender, if permissible, in accordance with ITT 15;
e) Authorization: written confirmation authorizing the signatory of the Tender to commit the Tenderer, in accordance with ITT 22.3;
f) Qualifications: documentary evidence in accordance with ITT 19 establishing the Tenderer's qualifications to perform the Contract if its Tender is accepted;
g) Conformity: a technical proposal in accordance with ITT 18;
h) Any other document required in the **TDS**.

13.2 In addition to the requirements under ITT 11.1, Tenders submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Tender shall be signed by all members and submitted with the Tender,together with a copy of the proposed Agreement. The Tenderer shall chronologically serialize pages of all tender documents submitted.

13.3 The Tenderer shall furnish in the Form of Tender information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Tender.

14. Form of Tender and Schedules

14.1 The Form of Tender and Schedules, including the Bill of Quantities, shall be prepared using the relevant forms furnished in Section IV, Tendering Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITT 20.3. All blank spaces shall be filled in with the information requested.

15. Alternative Tenders

15.1 Unless otherwise specified in the TDS, alternative Tenders shall not be considered.
When alternative times for completion are explicitly invited, a statement to that effect will be included in the TDS, and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification

Criteria.

15.2 Except as provided under ITT 13.4 below, Tenderers wishing to offer technical alternatives to the requirements of the Tender Documents must first price the Procuring Entity's design as described in the Tender Documents and shall further provide all information necessary for a complete evaluation of the alternative by the Procuring Entity, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the Tenderer with the Winning Tender conforming to the basic technical requirements shall be considered by the Procuring Entity. When specified in the TDS, Tenderers are permitted to submit alternative technical solutions for specified parts of the Works, and such parts will be identified in the TDS, as will the method for their evaluating, and described in Section VII, Works' Requirements.

16. Tender Prices and Discounts

16.1 The prices and discounts (including any price reduction) quoted by the Tenderer in the Form of Tender and in the Bill of Quantities shall conform to the requirements specified below.

16.2 The Tenderer shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Tenderer shall be deemed covered by the rates for other items in the Bill of Quantities and will not be paid for separately by the Procuring Entity. An item not listed in the priced Bill of Quantities shall be assumed to be not included in the Tender, and provided that the Tender is determined substantially responsive notwithstanding this omission, the average price of the item quoted by substantially responsive Tenderers will be added to the Tender price and the equivalent total cost of the Tender so determined will be used for price comparison.

16.3 The price to be quoted in the Form of Tender, in accordance with ITT 14.1, shall be the total price of the Tender, including any discounts offered.

16.4 The Tenderer shall quote any discounts and the methodology for their application in the Form of Tender, in accordance with ITT 14.1.

16.5 It will be specified in the TDS if the rates and prices quoted by the Tenderer are or are not subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, except in cases where the contract is subject to fluctuations and adjustments, not fixed price. In such a case, the Tenderer shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Procuring Entity may require the Tenderer to justify its proposed indices and weightings.

16.6 Where tenders are being invited for individual lots (contracts)or for any combination of lots (packages), tenderers wishing to offer discounts for the award of more than one Contract shall specify in their Tender the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITT 16.4, provided the Tenders for all lots (contracts) are opened at the same time.

16.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of Tenders, shall be included in the rates and prices and the total Tender Price submitted by the Tenderer.

17. Currencies of Tender and Payment

17.1 Tenderers shall quote entirely in Kenya Shillings. The unit rates and the prices shall be quoted by the Tenderer in the Bill of Quantities, entirely in Kenya shillings. A Tenderer expecting to incur expenditures in other currencies for inputs to the Works supplied from outside Kenya shall device own ways of getting foreign currency to meet those expenditures.

18. Documents Comprising the Technical Proposal

18.1 The Tenderer shall furnish a technical proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section IV, Tender Forms, in sufficient detail to demonstrate the adequacy of the Tenderer's proposal to meet the work's requirements and the completion time.

19. Documents Establishing the Eligibility and Qualifications of the Tenderer

19.1 Tenderers shall complete the Form of Tender, included in Section IV, Tender Forms, to establish Tenderer's eligibility in accordance with ITT 4.

19.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract the Tenderer shall provide the information requested in the corresponding information sheets included in Section IV, Tender Forms.

19.3 A margin of preference will not be allowed. Preference and reservations will be allowed, individually or in joint ventures.

Applying for eligibility for Preference and reservations shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITT 33.1.

19.4 Tenderers shall be asked to provide, as part of the data for qualification, such information, including details of ownership, as shall be required to determine whether, according to the classification established by the Procuring Entity, a contractor or group of contractors qualifies for a margin of preference. Further the information will enable the Procuring Entity identify any actual or potential conflict of interest in relation to the procurement and/or contract management processes, or a possibility of collusion between tenderers, and thereby help to prevent any corrupt influence in relation to the procurement process or contract management.

19.5 The purpose of the information described in ITT 19.4 above overrides any claims to confidentiality which a tenderer may have. There can be no circumstances in which it would be justified for a tenderer to keep information relating to its ownership and control confidential where it is tendering to undertake public sector work and receive public sector funds. Thus, confidentiality will not be accepted by the Procuring Entity as a justification for a Tenderer's failure to disclose, or failure to provide required information on its ownership and control.

19.6 The Tenderer shall provide further documentary proof, information or authorizations that the Procuring Entity may request in relation to ownership and control which information on any changes to the information which was provided by the tenderer under ITT 6.3. The obligations to require this information shall continue for the duration of the procurement process and contract performance and after completion of the contract, if any change to the information previously provided may reveal a conflict of interest in relation to the award or management of the contract.

19.7 All information provided by the tenderer pursuant to these requirements must be complete, current and accurate as at the date of provision to the Procuring Entity. In submitting the information required pursuant to these requirements, the Tenderer shall warrant that the information submitted is complete, current and accurate as at the date of submission to the Procuring Entity.

19.8 If a tenderer fails to submit the information required by these requirements, its tender will be rejected. Similarly, if the Procuring Entity is unable, after taking reasonable steps, to verify to a reasonable degree the information submitted by a tenderer pursuant to these requirements, then the tender will be rejected.

19.9 If information submitted by a tenderer pursuant to these requirements, or obtained by the Procuring Entity (whether through its own enquiries, through notification by the public or otherwise), shows any conflict of interest which could materially and improperly benefit the tenderer in relation to the procurement or contract management process, then:

i) if the procurement process is still ongoing, the tenderer will be disqualified from the procurement process,
ii) if the contract has been awarded to that tenderer, the contract award will be set aside,
iii) the tenderer will be referred to the relevant law enforcement authorities for investigation of whether the tenderer or any other persons have committed any criminal offence.

19.10 If a tenderer submits information pursuant to these requirements that is incomplete, inaccurate or out-of-date, or attempts to obstruct the verification process, then the consequences ITT 6.7 will ensue unless the tenderer can show to the reasonable satisfaction of the Procuring Entity that any such act was not material, or was due to genuine error which was not attributable to the intentional act, negligence or recklessness of the tenderer.

20. Period of Validity of Tenders

20.1 Tenders shall remain valid for the Tender Validity period specified in the TDS. The Tender Validity period starts from the date fixed for the Tender submission deadline (as prescribed by the Procuring Entity in accordance with ITT 24).

20.2 A Tender valid for a shorter period shall be rejected by the Procuring Entity as non-responsive.
In exceptional circumstances, prior to the expiration of the Tender validity period, the Procuring Entity may request Tenderers to extend the period of validity of their Tenders. The request and the responses shall be made in writing. If a Tender Security is requested in accordance with ITT 21.1, it shall also be extended for thirty (30) days beyond the deadline of the extended validity period. A Tenderer may refuse the request without forfeiting its Tender security. A Tenderer granting the request shall not be required or permitted to modify its Tender, except as provided in ITT 20.3.

20.3 If the award is delayed by a period exceeding the number of days to be specified in the TDS days beyond the expiry of the initial tender validity period, the Contract price shall be determined as follows:

a) in the case of **fixed price** contracts, the Contract price shall be the tender price adjusted by the factor specified in the **TDS**;
b) in the case of **adjustable price** contracts, no adjustment shall be made; or in any case, tender evaluation

shall be based on the tender price without taking into consideration the applicable correction from those indicated above.

21. Tender Security

21.1 The Tenderer shall furnish as part of its Tender, either a Tender-Securing Declaration or a Tender Security as specified in the TDS, in original form and, in the case of a Tender Security, in the amount and currency specified in the TDS. A Tender-Securing Declaration shall use the form included in Section IV, Tender Forms.

21.2 If a Tender Security is specified pursuant to ITT 19.1, the Tender Security shall be a demand guarantee in any of the following forms at the Tenderer's option:

a) an unconditional Bank Guarantee issued by reputable commercial bank); or
b) an irrevocable letter of credit;
c) a Banker's cheque issued by a reputable commercial bank; or
d) another security specified **in the TDS**,

21.3 If an unconditional bank guarantee is issued by a bank located outside Kenya, the issuing bank shall have a correspondent bank located in Kenya to make it enforceable. The Tender Security shall be valid for thirty (30) days beyond the original validity period of the Tender, or beyond any period of extension if requested under ITT 20.2.

21.4 If a Tender Security or Tender-Securing Declaration is specified pursuant to ITT 19.1, any Tender not accompanied by a substantially responsive Tender Security or Tender-Securing Declaration shall be rejected by the Procuring Entity as non-responsive.

21.5 If a Tender Security is specified pursuant to ITT 21.1, the Tender Security of unsuccessful Tenderers shall be returned as promptly as possible upon the successful Tenderer's signing the Contract and furnishing the Performance Security and any other documents required in the TDS. The Procuring Entity shall also promptly return the tender security to the tenderers where the procurement proceedings are terminated, all tenders were determined nonresponsive or a bidder declines to extend tender validity period.

21.6 The Tender Security of the successful Tenderer shall be returned as promptly as possible once the successful Tenderer has signed the Contract and furnished the required Performance Security, and any other documents required in the TDS.

21.7 The Tender Security may be forfeited or the Tender-Securing Declaration executed:

e) if a Tenderer withdraws its Tender during the period of Tender validity specified by the Tenderer on the Form of Tender, or any extension thereto provided by the Tenderer; or
f) if the successful Tenderer fails to:
   i) sign the Contract in accordance with ITT 50; or
   ii) furnish a Performance Security and if required in the **TDS**, and any other documents required in the **TDS**.

21.8 Where tender securing declaration is executed, the Procuring Entity shall recommend to the PPRA that PPRA debars the Tenderer from participating in public procurement as provided in the law.

21.9 The Tender Security or the Tender-Securing Declaration of a JV shall be in the name of the JV that submits the Tender. If the JV has not been legally constituted into a legally enforceable JV at the time of tendering, the Tender Security or the Tender-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITT 4.1 and ITT 11.2.

21.10 A tenderer shall not issue a tender security to guarantee itself.

22. Format and Signing of Tender

22.1 The Tenderer shall prepare one original of the documents comprising the Tender as described in ITT 13 and clearly mark it "ORIGINAL." Alternative Tenders, if permitted in accordance with ITT 15, shall be clearly marked "ALTERNATIVE." In addition, the Tenderer shall submit copies of the Tender, in the number specified in the TDS and clearly mark them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

22.2 Tenderers shall mark as "CONFIDENTIAL" all information in their Tenders which is confidential to their business. This may include proprietary information, trade secrets, or commercial or financially sensitive information.

22.3 The original and all copies of the Tender shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. This authorization shall consist of a written confirmation as specified in the TDS and shall be attached to the Tender. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Tender where entries or amendments have been made shall be signed or initialed by the person signing the Tender.

22.4 In case the Tenderer is a JV, the Tender shall be signed by an authorized representative of the JV on behalf of the JV, and to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.

22.5 Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Tender.

D. Submission and Opening of Tenders

23. Sealing and Marking of Tenders

23.1 Depending on the sizes or quantities or weight of the tender documents, a tenderer may use an envelope, package or container. The Tenderer shall deliver the Tender in a single sealed envelope, or in a single sealed package, or in a single sealed container bearing the name and Reference number of the Tender, addressed to the Procuring Entity and a warning not to open before the time and date for Tender opening date. Within the single envelope, package or container, the Tenderer shall place the following separate, sealed envelopes:

a) in an envelope or package or container marked "ORIGINAL", all documents comprising the Tender, as described in ITT 11; and

b) in an envelope or package or container marked "COPIES", all required copies of the Tender; and

c) if alternative Tenders are permitted in accordance with ITT 15, and if relevant:

   i) in an envelope or package or container marked "ORIGINAL –ALTERNATIVE TENDER", the alternative Tender; and

   ii) in the envelope or package or container marked "COPIES- ALTERNATIVE TENDER", all required copies of the alternative Tender.

The inner envelopes or packages or containers shall:

a) bear the name and address of the Procuring Entity.

b) bear the name and address of the Tenderer; and

c) bear the name and Reference number of the Tender.

23.1 If an envelope or package or container is not sealed and marked as required, the *Procuring Entity* will assume no responsibility for the misplacement or premature opening of the Tender. Tenders that are misplaced or opened prematurely will not be accepted.

24. Deadline for Submission of Tenders

24.1 Tenders must be received by the Procuring Entity at the address specified in the TDS and no later than the date and time also specified in the TDS. When so specified in the TDS, Tenderers shall have the option of submitting their Tenders electronically. Tenderers submitting Tenders electronically shall follow the electronic Tender submission procedures specified in the TDS.

24.2 The Procuring Entity may, at its discretion, extend the deadline for the submission of Tenders by amending the Tender Documents in accordance with ITT 8, in which case all rights and obligations of the Procuring Entity and Tenderers previously subject to the deadline shall thereafter be subject to the deadline as extended.

25. Late Tenders

25.1 The Procuring Entity shall not consider any Tender that arrives after the deadline for submission of tenders, in accordance with ITT 24. Any Tender received by the Procuring Entity after the deadline for submission of Tenders shall be declared late, rejected, and returned unopened to the Tenderer.

26. Withdrawal, Substitution, and Modification of Tenders

26.1 A Tenderer may withdraw, substitute, or modify its Tender after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITT 22.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Tender must accompany the

respective written notice. All notices must be:

a) prepared and submitted in accordance with ITT 22 and ITT 23 (except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," "MODIFICATION;"and

b) received by the Procuring Entity prior to the deadline prescribed for submission of Tenders, in accordance with ITT 24.

26.2 Tenders requested to be withdrawn in accordance with ITT 26.1 shall be returned unopened to the Tenderers.

26.1 No Tender may be withdrawn, substituted, or modified in the interval between the deadline for submission of Tenders and the expiration of the period of Tender validity specified by the Tenderer on the Form of Tender or any extension thereof.

27. Tender Opening

27.1 Except in the cases specified in ITT 23 and ITT 26.2, the Procuring Entity shall publicly open and read out all Tenders received by the deadline, at the date, time and place specified in the TDS, in the presence of Tenderers' designated representatives who chooses to attend. Any specific electronic Tender opening procedures required if electronic Tendering is permitted in accordance with ITT 24.1, shall be as specified in the TDS.
First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelopes with the corresponding Tender shall not be opened, but returned to the Tenderer. No Tender withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Tender opening.

27.2 Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Tender being substituted, and the substituted Tender shall not be opened, but returned to the Tenderer. No Tender substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Tender opening.
Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Tender. No Tender modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Tender opening.

27.1 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Tenderer and whether there is a modification; the total Tender Price, per lot (contract) if applicable, including any discounts and alternative Tenders; the presence or absence of a Tender Security or Tender-Securing Declaration, if required; and any other details as the Procuring Entity may consider appropriate.
Only Tenders, alternative Tenders and discounts that are opened and read out at Tender opening shall be considered further for evaluation. The Form of Tender and pages of the Bills of Quantities are to be initialed by the members of the tender opening committee attending the opening. The number of representatives of the Procuring Entity to sign shall be specified in the TDS.

27.2 At the Tender Opening, the Procuring Entity shall neither discuss the merits of any Tender nor reject any Tender (except for late Tenders, in accordance with ITT 25.1).

27.3 The Procuring Entity shall prepare minutes of the Tender Opening that shall include, as a minimum:

a) the name of the Tenderer and whether there is a withdrawal, substitution, or modification;

b) the Tender Price, per lot (contract) if applicable, including any discounts;

c) any alternative Tenders;

d) the presence or absence of a Tender Security, if one was required.

e) number of pages of each tender document submitted.

28.1 The Tenderers' representatives who are present shall be requested to sign the minutes. The omission of a Tenderer's signature on the minutes shall not invalidate the contents and effect of the minutes. A copy of the tender opening register shall be distributed to all Tenderers upon request.

E. Evaluation and Comparison of Tenders

28. Confidentiality

28.1 Information relating to the evaluation of Tenders and recommendation of contract award shall not be disclosed to Tenderers or any other persons not officially concerned with the Tender process until information on Intention to Award the Contract is transmitted to all Tenderers in accordance with ITT 46.

28.2 Any effort by a Tenderer to influence the Procuring Entity in the evaluation of the Tenders or Contract award decisions may result in the rejection of its tender.

28.3 Notwithstanding ITT 28.2, from the time of tender opening to the time of contract award, if a tenderer wishes to contact the Procuring Entity on any matter related to the tendering process, it shall do so in writing.

29. Clarification of Tenders

29.1 To assist in the examination, evaluation, and comparison of the tenders, and qualification of the tenderers, the Procuring Entity may, at its discretion, ask any tenderer for a clarification of its tender, given a reasonable time for a response. Any clarification submitted by a tenderer that is not in response to a request by the Procuring Entity shall not be considered. The Procuring Entity's request for clarification and the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the tender shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Procuring Entity in the evaluation of the tenders, in accordance with ITT 33.

29.2 If a tenderer does not provide clarifications of its tender by the date and time set in the Procuring Entity's request for clarification, its Tender may be rejected.

30. Deviations, Reservations, and Omissions

30.1 During the evaluation of tenders, the following definitions apply:

a) "Deviation" is a departure from the requirements specified in the tender document;

b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the tender document; and

c) "Omission" is the failure to submit part or all of the information or documentation required in the Tender document.

31. Determination of Responsiveness

31.1 The Procuring Entity's determination of a Tender's responsiveness is to be based on the contents of the tender itself, as defined in ITT 13.

31.2 A substantially responsive Tender is one that meets the requirements of the Tender document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that, if accepted, would:

a) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

b) limit in any substantial way, inconsistent with the tender document, the Procuring Entity's rights or the tenderer's obligations under the proposed contract; or

c) if rectified, would unfairly affect the competitive position of other tenderers presenting substantially responsive tenders.

31.3 The Procuring Entity shall examine the technical aspects of the tender submitted in accordance with ITT 18, to confirm that all requirements of Section VII, Works' Requirements have been met without any material deviation, reservation or omission.

31.4 If a tender is not substantially responsive to the requirements of the tender document, it shall be rejected by the Procuring Entity and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

32. Non-material Non-conformities

32.1 Provided that a tender is substantially responsive, the Procuring Entity may waive any non-conformities in the tender.

32.2 Provided that a Tender is substantially responsive, the Procuring Entity may request that the tenderer submit the necessary information or documentation, within a reasonable period, to rectify nonmaterial non-conformities in the tender related to documentation requirements. Requesting information or documentation on such non- conformities shall not be related to any aspect of the price of the tender. Failure of the tenderer to comply with the request may result in the rejection of its tender.

32.3 Provided that a tender is substantially responsive, the Procuring Entity shall rectify quantifiable nonmaterial non-conformities related to the Tender Price. To this effect, the Tender Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner specified in the TDS.

33. Arithmetical Errors

33.1 The tender sum as submitted and read out during the tender opening shall be absolute and final and shall not be the subject of correction, adjustment or amendment in any way by any person or entity.

33.2 Provided that the Tender is substantially responsive, the Procuring Entity shall handle errors on the following basis:

a) Any error detected if considered a major deviation that affects the substance of the tender, shall lead to

disqualification of the tender as non-responsive.

b) Any errors in the submitted tender arising from a miscalculation of unit price, quantity, and subtotal and total bid price shall be considered as a major deviation that affects the substance of the tender and shall lead to disqualification of the tender as non-responsive. and

c) if there is a discrepancy between words and figures, the amount in words shall prevail

33.3 Tenderers shall be notified of any error detected in their bid during the notification of a ward.

34. Currency provisions

34.1 Tenders will priced be in Kenya Shillings only. Tenderers quoting in currencies other than in Kenya shillings will be determined non-responsive and rejected.

35. Margin of Preference and Reservations

35.1 No margin of preference shall be allowed on contracts for small works.

35.2 Where it is intended to reserve the contract to specific groups under Small and Medium Enterprises, or enterprise of women, youth and/or persons living with disability, who are appropriately registered as such by the authority to be specified in the TDS, a procuring entity shall ensure that the invitation to tender specifically indicates that only businesses/firms belonging to those specified groups are the only ones eligible to tender. Otherwise, if no so stated, the invitation will be open to all tenderers.

36. Nominated Subcontractors

36.1 Unless otherwise stated in the TDS, the Procuring Entity does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Procuring Entity.

36.2 Tenderers may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified in the TDS. Subcontractors proposed by the Tenderer shall be fully qualified for their parts of the Works.

36.3 The subcontractor's qualifications shall not be used by the Tenderer to qualify for the Works unless their specialized parts of the Works were previously designated by the Procuring Entity in the TDS as can be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Tenderer may be added to the qualifications of the Tenderer.

37. Evaluation of Tenders

37.1 The Procuring Entity shall use the criteria and methodologies listed in this ITT and Section III, Evaluation and Qualification Criteria. No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies the Procuring Entity shall determine the Best Evaluated Tender in accordance with ITT 40.

37.2 To evaluate a Tender, the Procuring Entity shall consider the following:

a) price adjustment due to discounts offered in accordance with ITT16;

b) converting the amount resulting from applying (a) and (b) above, if relevant, to a single currency in accordance with ITT39;

c) price adjustment due to quantifiable nonmaterial non-conformities in accordance with ITT 30.3; and

d) any additional evaluation factors specified **in the TDS** and Section III, Evaluation and Qualification Criteria.

37.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be considered in Tender evaluation.

37.4 In the case of multiple contracts or lots, Tenderers shall be allowed to tender for one or more lots and the methodology to determine the lowest evaluated cost of the lot (contract) combinations, including any discounts offered in the Form of Tender, is specified in Section III, Evaluation and Qualification Criteria.

38. Comparison of Tenders

38.1 The Procuring Entity shall compare the evaluated costs of all substantially responsive Tenders established in accordance with ITT 38.2 to determine the Tender that has the lowest evaluated cost.

39. Abnormally Low Tenders

39.1 An Abnormally Low Tender is one where the Tender price, in combination with other elements of the Tender, appears so low that it raises material concerns as to the capability of the Tenderer in regards to the Tenderer's ability to perform the Contract for the offered Tender Price or that genuine competition between Tenderers is compromised.

39.2 In the event of identification of a potentially Abnormally Low Tender, the Procuring Entity shall seek written

clarifications from the Tenderer, including detailed price analyses of its Tender price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the Tender document.

39.3 After evaluation of the price analyses, in the event that the Procuring Entity determines that the Tenderer has failed to demonstrate its capability to perform the Contract for the offered Tender Price, the Procuring Entity shall reject the Tender.

40. Abnormally High Tenders

40.1 An abnormally high price is one where the tender price, in combination with other constituent elements of the Tender, appears unreasonably too high to the extent that the Procuring Entity is concerned that it (the Procuring Entity) may not be getting value for money or it may be paying too high a price for the contract compared with market prices or that genuine competition between Tenderers is compromised.

40.2 In case of an abnormally high tender price, the Procuring Entity shall make a survey of the market prices, check if the estimated cost of the contract is correct and review the Tender Documents to check if the specifications, scope of work and conditions of contract are contributory to the abnormally high tenders. The Procuring Entity may also seek written clarification from the tenderer on the reason for the high tender price. The Procuring Entity shall proceed as follows:

i) If the tender price is abnormally high based on wrong estimated cost of the contract, the Procuring Entity may accept or not accept the tender depending on the Procuring Entity's budget considerations.

ii) If specifications, scope of work and/or conditions of contract are contributory to the abnormally high tender prices, the Procuring Entity shall reject all tenders and may retender for the contract based on revised estimates, specifications, scope of work and conditions of contract, as the case may be.

40.3 If the Procuring Entity determines that the Tender Price is abnormally too high because genuine competition between tenderers is compromised (*often due to collusion, corruption or other manipulations*), the Procuring Entity shall reject all Tenders and shall institute or cause competent Government Agencies to institute an investigation on the cause of the compromise, before retendering.

41. Unbalanced and/or Front-Loaded Tenders

41.1 If in the Procuring Entity's opinion, the Tender that is evaluated as the lowest evaluated price is seriously unbalanced and/or front loaded, the Procuring Entity may require the Tenderer to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the tender prices with the scope of works, proposed methodology, schedule and any other requirements of the Tender document.

41.2 After the evaluation of the information and detailed price analyses presented by the Tenderer, the Procuring Entity may as appropriate:

a) accept the Tender; or

b) require that the total amount of the Performance Security be increased at the expense of the Tenderer to a level not exceeding a 30% of the Contract Price; or

c) agree on a payment mode that eliminates the inherent risk of the Procuring Entity paying too much for undelivered works; or

d) reject the Tender,

42. Qualifications of the Tenderer

42.1 The Procuring Entity shall determine to its satisfaction whether the eligible Tenderer that is selected as having submitted the lowest evaluated cost and substantially responsive Tender, meets the qualifying criteria specified in Section III, Evaluation and Qualification Criteria.

42.2 The determination shall be based upon an examination of the documentary evidence of the Tenderer's qualifications submitted by the Tenderer, pursuant to ITT 19. The determination shall not take into consideration the qualifications of other firms such as the Tenderer's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the Tender document), or any other firm(s) different from the Tenderer.

42.3 An affirmative determination shall be a prerequisite for award of the Contract to the Tenderer. A negative determination shall result in disqualification of the Tender, in which event the Procuring Entity shall proceed to the Tenderer who offers a substantially responsive Tender with the next lowest evaluated price to make a similar determination of that Tenderer's qualifications to perform satisfactorily.

42.4 An Abnormally Low Tender is one where the Tender price, in combination with other elements of the Tender, appears so low that it raises material concerns as to the capability of the Tenderer in regards to the Tenderer's ability to perform the

Contract for the offered Tender Price.

42.5 In the event of identification of a potentially Abnormally Low Tender, the Procuring Entity shall seek written clarifications from the Tenderer, including detailed price analyses of its Tender price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the Tender document.

42.6 After evaluation of the price analyses, if the Procuring Entity determines that the Tenderer has failed to demonstrate its capability to perform the Contract for the offered Tender Price, the Procuring Entity shall reject the Tender.

43. Best Evaluated Tender

43.1 Having compared the evaluated prices of Tenders, the Procuring Entity shall determine the Best Evaluated Tender. The Best Evaluated Tender is the Tender of the Tenderer that meets the Qualification Criteria and whose Tender has been determined to be:

a) Most responsive to the Tender document; and
b) the lowest evaluated price.

44. Procuring Entity's Right to Accept Any Tender, and to Reject Any or All Tenders.

44.1 The Procuring Entity reserves the right to accept or reject any Tender and to annul the Tender process and reject all Tenders at any time prior to Contract Award, without thereby incurring any liability to Tenderers. In case of annulment, all Tenderers shall be notified with reasons and all Tenders submitted and specifically, Tender securities, shall be promptly returned to the Tenderers.

F. Award of Contract

45. Award Criteria

45.1 The Procuring Entity shall award the Contract to the successful tenderer whose tender has been determined to be the Lowest Evaluated Tender.

46. Notice of Intention to enter into a Contract

46.1 Upon award of the contract and prior to the expiry of the Tender Validity Period the Procuring Entity shall issue a Notification of Intention to Enter into a Contract / Notification of award to all tenderers which shall contain, at a minimum, the following information:

a) the name and address of the Tenderer submitting the successful tender;
b) the Contract price of the successful tender;
c) a statement of the reason(s) the tender of the unsuccessful tenderer to whom the letter is addressed was unsuccessful, unless the price information in (c) above already reveals the reason;
d) the expiry date of the Standstill Period; and
e) instructions on how to request a debriefing and/or submit a complaint during the standstill period;

47. Standstill Period

47.1 The Contract shall not be signed earlier than the expiry of a Standstill Period of 14 days to allow any dissatisfied tender to launch a complaint. Where only one Tender is submitted, the Standstill Period shall not apply.

47.2 Where a Standstill Period applies, it shall commence when the Procuring Entity has transmitted to each Tenderer the Notification of Intention to Enter into a Contract with the successful Tenderer.

48. Debriefing by the Procuring Entity

48.1 On receipt of the Procuring Entity's Notification of Intention to Enter into a Contract referred to in ITT 46, an unsuccessful tenderer may make a written request to the Procuring Entity for a debriefing on specific issues or concerns regarding their tender. The Procuring Entity shall provide the debriefing within five days of receipt of the request.

48.2 Debriefings of unsuccessful Tenderers may be done in writing or verbally. The Tenderer shall bear its own costs of attending such a debriefing meeting.

49. Letter of Award

49.1 Prior to the expiry of the Tender Validity Period and upon expiry of the Standstill Period specified in ITT 42.1, upon addressing a complaint that has been filed within the Standstill Period, the Procuring Entity shall transmit the Letter of Award to the successful Tenderer. The letter of award shall request the successful tenderer to furnish the Performance Security within

21days of the date of the letter.

50. Signing of Contract

50.1 Upon the expiry of the fourteen days of the Notification of Intention to enter into contract and upon the parties meeting their respective statutory requirements, the Procuring Entity shall send the successful Tenderer the Contract Agreement.

50.2 Within fourteen (14) days of receipt of the Contract Agreement, the successful Tenderer shall sign, date, and return it to the Procuring Entity.

50.3 The written contract shall be entered into within the period specified in the notification of award and before expiry of the tender validity period

51. Appointment of Adjudicator

51.1 The Procuring Entity proposes the person named in the TDS to be appointed as Adjudicator under the Contract, at the hourly fee specified in the TDS, plus reimbursable expenses. If the Tenderer disagrees with this proposal, the Tenderer should so state in his Tender. If, in the Letter of Acceptance, the Procuring Entity does not agree on the appointment of the Adjudicator, the Procuring Entity will request the Appointing Authority designated in the Special Conditions of Contract (SCC) pursuant to Clause 23.1 of the General Conditions of Contract (GCC), to appoint the Adjudicator.

52. Performance Security

52.1 Within twenty-one (21) days of the receipt of the Letter of Acceptance from the Procuring Entity, the successful Tenderer shall furnish the Performance Security and, any other documents required in the **TDS**, in accordance with the General Conditions of Contract, subject to ITT 40.2 (b), using the Performance Security and other Forms included in Section X, Contract Forms, or another form acceptable to the Procuring Entity. A foreign institution providing a bank guarantee shall have a correspondent financial institution located in Kenya, unless the Procuring Entity has agreed in writing that a correspondent bank is not required.

52.2 Failure of the successful Tenderer to submit the above-mentioned Performance Security and other documents required in the **TDS**, or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Tender Security. In that event the Procuring Entity may award the Contract to the Tenderer offering the next Best Evaluated Tender.

52.3 Performance security shall not be required for contracts estimated to cost less than Kenya shillings five million shillings**.**

53. Publication of Procurement Contract

53.1 Within fourteen days after signing the contract, the Procuring Entity shall publish the awarded contract at its notice boards and websites; and on the Website of the Authority. At the minimum, the notice shall contain the following information:

a) name and address of the Procuring Entity;
b) name and reference number of the contract being awarded, a summary of its scope and the selection method used;
c) the name of the successful Tenderer, the final total contract price, the contract duration.
d) dates of signature, commencement and completion of contract;
e) names of all Tenderers that submitted Tenders, and their Tender prices as read out at Tender opening.

54. Procurement Related Complaints and Administrative Review

54.1 The procedures for making Procurement-related Complaints are as specified in the TDS.

54.2 A request for administrative review shall be made in the form provided under contract forms.

Section II - Tender Data Sheet (TDS)

The following specific data shall complement, supplement, or amend the provisions in the Instructions to Tenderers (ITT). Whenever there is a conflict, the provisions herein shall prevail over those in ITT.

ITT Reference	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	A. General
ITT 1.1	The name of the contract is **Construction of LESOIT WATER DAM PROJECT** The reference number of the **Contract is - NWWDA/T/CW/015/2022-2023**
ITT 2.3	The Information made available on competing firms is as follows: N/A
ITT 2.4	The firms that provided consulting services for the contract being tendered for are: __N/A_____
ITT 3.1	Maximum number of members in the Joint Venture (JV) shall be: ***One***
B. Contents of Tender Document	
8.1	(A) Pre-Tender conference *"**shall not**"* take place at the (B) A pre-arranged pretender visit of the site of the works *"**shall not**"* take place at the following date, time and place:
ITT 8.2	The Tenderer will submit any questions in writing, to reach the Procuring Entity not later than **7th June 2023**
ITT 8.4	The Procuring Entity's website where Minutes of the pre-Tender meeting and the pre-arranged pretender site visit will be published is N/A
ITT 9.1	For Clarification of Tender purposes, for obtaining further information and for purchasing tender documents, the Procuring Entity's address is: (1) The tenderer will submit any request for clarifications in writing at the address Chief Executive Officer, Northern Water Works Development Agency Po Box 495- 70100 Garissa, Maji House, Kismayu Road info@nwwda.go.ke to reach the procuring Entity not later
C. Preparation of Tenders	
ITP 13.1 (h)	The Tenderer shall submit the following additional documents in its Tender: - Preliminary Evaluation **MR 1- Copy of certificate of Registration/Incorporation** **MR 2 –Copy of Valid tax compliance Certificate** **MR 3 – Must fill Bill of quantities in format provided (incomplete BOQs will be rejected)** **MR 4- Must fill the form of tender in the format provided and signed by authorized person with power of attorney to commit the bid.** **MR 6- Must provide tender security (unconditional bank guarantee) of Kshs 1,200,000 valid 30 days beyond bid validity period** **MR 7 – NCA 4 Water Works and above**
ITT 15.1	Alternative Tenders ***"shall not be"***_____ considered.
ITT 15.2	N/A
ITT 15.4	N/A

ITT Reference	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
ITT 16.5	The prices quoted by the Tenderer shall be: *"fixed"*
ITT 20.1	The Tender validity period shall be ***90*** days.
ITT 20.3 (a)	(a) The delayed to exceeding **180 days.** (b) The Tender price shall be adjusted by the following percentages of the tender price: (i) By **0%** of t*he local currency portion of the Contract price adjusted to reflect local inflation during the period of extension,* *and* *(ii) By___**N/A**_____% the foreign currency portion of the Contract price adjusted to reflect the international inflation during the period of extension.*
ITT 21.1	A Tender Security *"**shall be**"* required. If a Tender Security shall be required, the amount and currency of the Tender Security shall be Kenya Shillings **1,200,000.00 valid 30 days beyond the bid validity period (unconditional bank guarantee**
ITT 21.2 (d)	The other Tender Security shall be N/A
ITT 21.5	N/A
ITT 22.1	In addition to the original of the Tender, the number of copies is**: One Original and One Copy**
ITT 22.3	The written confirmation of authorization to sign on behalf of the Tenderer shall consist of: **Power of Attorney**
D. Submission and Opening of Tenders	
ITT 24.1	(A) For Tender submission purposes only, the Procuring Entity's address is: **Northern Water Works Development Agency** Street Address: **Maji House, Kismayu Road** City: **Garissa** ZIP Code: **70100** Country: **KENYA** **Procurement Office, Ground Floor, Room A3** The deadline for Tender Submission is **14th June , 2023 at 11.00 am.** Tenderer shall not have the option of submitting their Tenders Electronically
ITT 27.1	The Tender opening shall take place at the time and the address for Opening of Tenders provided below: Northern Water Works Development Agency, Po Box 495- 70100 Garissa, Maji House, Kismayu Road Conference room, 1st Floor.

ITT Reference	PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERS
	On 14th June 2023 at 11,30 am
ITT 27.1	N/A
ITT 27.6	The number of representatives of the Procuring Entity to sign is Three.
E. Evaluation, and Comparison of Tenders	
ITT 32.3	The adjustment shall be based on the *"highest"* price of the item or component as quoted in other substantially responsive Tenders. If the price of the item or component cannot be derived from the price of other substantially responsive Tenders, the Procuring Entity shall use its best estimate.
ITT 35.2	The invitation to tender is extended to the following groups that qualify for Reservations N/A
ITT 36.1	At this time, the Procuring Entity _____ *"does not intend"* to execute certain specific parts of the Works by subcontractors selected in advance.
ITT 36.2	Contractor's may propose subcontracting: Maximum percentage of subcontracting permitted is: *10 % of the total contract amount.* Tenderers planning to subcontract more than 10% of total volume of work shall specify, in the Form of Tender, the activity (ies) or parts of the Works to be subcontracted along with complete details of the subcontractors and their qualification and experience.
ITT 36.3	The parts of the Works for which the Procuring Entity permits Tenderers to propose Specialized Subcontractors are designated as follows: _____N/A For the above-designated parts of the Works that may require Specialized Subcontractors, the relevant qualifications of the proposed Specialized Subcontractors will be added to the qualifications of the Tenderer for the purpose of evaluation.
ITT 37.2 (d)	Additional requirements apply. These are detailed in the evaluation criteria in Section III, Evaluation and Qualification Criteria.
ITT 51.1	The person named to be appointed as Adjudicator is _____ of _____*(pride tel. no. full postal and email addresses)* at an hourly fee of Shs._____ per day.
ITT 52.2	Other documents required are _____
ITT 54.1	The procedures for making a Procurement-related Complaints are detailed in the "Regulations" available from the PPRA Website www.ppra.go.ke or email complaints@ppra.go.ke. If a Tenderer wishes to make a Procurement-related Complaint, the Tenderer should submit its complaint following these procedures, in writing (by the quickest means available, that is either by hand delivery or email to: For the attention: *Andrew Rage Eysimkele* Title/position: *Ag. Chief Executive Officer* Procuring Entity: *Northern Water Works Development Agency* Email address*: info@nwwda.go.ke* In summary, a Procurement-related Complaint may challenge any of the following: (i) the terms of the Tender Documents; and (ii) the Procuring Entity's decision to award the contract.

SECTION III - EVALUATION AND QUALIFICATION CRITERIA

1. General Provisions

Wherever a Tenderer is required to state a monetary amount, Tenderers should indicate the Kenya Shilling equivalent using the rate of exchange determined as follows:

a) For construction turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year (in which the amounts for that year is to be converted) was originally established.
b) Value of single contract - Exchange rate prevailing on the date of the contract signature.
c) Exchange rates shall be taken from the publicly available source identified in the ITT 14.3. Any error in determining the exchange rates in the Tender may be corrected by the Procuring Entity.

This section contains the criteria that the Employer shall use to evaluate tender and qualify tenderers. No other factors, methods or criteria shall be used other than specified in this tender document. The Tenderer shall provide all the information requested in the forms included in Section IV, Tendering Forms. The Procuring Entity should use **the Standard Tender Evaluation Document for Goods and Works** for evaluating Tenders.

Evaluation and contract award Criteria

The Procuring Entity shall use the criteria and methodologies listed in this Section to evaluate tenders and arrive at the Lowest Evaluated Tender. The tender that (i) meets the qualification criteria, (ii) has been determined to be substantially responsive to the Tender Documents, and (iii) is determined to have the Lowest Evaluated Tender price shall be selected for award of contract.

2. Preliminary examination for Determination of Responsiveness

The Procuring Entity will start by examining all tenders to ensure they meet in all respects the eligibility criteria and other requirements in the ITT, and that the tender is complete in all aspects in meeting the requirements of "Part 2 – Procuring Entity's Works Requirements", including checking for tenders with unacceptable errors, abnormally low tenders, abnormally high tenders and tenders that are front loaded. The Standard Tender Evaluation Report Document for Goods and Works for evaluating Tenders provides very clear guide on how to deal with review of these requirements. Tenders that do not pass the Preliminary Examination will be considered irresponsive and will not be considered further.

Prior to technical evaluation the tenderer shall be subjected to mandatory preliminary evaluation using the below listed criteria. The evaluation shall be on Responsive/Non Responsive criteria and a tenderer must pass all stated mandatory preliminary requirements in order to proceed to the next stage of technical evaluation. Any Non Responsive in any criteria shall result in overall FAIL.

MR	DESCRIPTION	Responsive/Non -Responsive
1	The Tender is signed and by the person with power of attorney, without material deviation, reservation, or omission.	
2	There is a letter granting power of attorney to sign the contract, if so required.	
3	Tenderer is a legally registered entity.	
4	If Tenderer is a JV, it is properly constituted.	
5	Valid Tax Compliance Certificate	
6	A Tender-Securing Declaration/Tender Security as required.	
7	A Tenderer has not participated in more than one Tender, except for permitted alternative tenders	
8	Tenderer has not been debarred by the PPRA or any other recognized institution.	
9	Tenderer is a commercially autonomous Kenyan State-owned Enterprise.	
10	Tenderer has no conflicts of interest.	
11	Tender has met all scope of requirements and specifications without any material deviation, reservation or omission	

12	The tenderer is not insolvent, in receivership, bankrupt or in the process of being wound up.	
13	The tender is valid for the required number of days.	
14	For Kenyan Tenderers, Tenderer is registered with appropriate authority (NCA 4Water Works and above).	

3. **Tender Evaluation (ITT 35) Price evaluation**: in addition to the criteria listed in ITT 35.2 (a) – (c) the following criteria shall apply:

i) **Alternative Completion Times, i**f permitted under ITT 13.2, will be evaluated as follows:
N/A

ii) **Alternative Technical Solutions** for specified parts of the Works, if permitted under ITT 13.4, will be evaluated as follows: N/A

iii) **Other Criteria; i**f permitted under ITT 35.2(d):
N/A

4. **Multiple Contracts**

Multiple contracts will be permitted in accordance with ITT 35.4. Tenderers are evaluated on basis of Lots and the lowest evaluated tenderer identified for each Lot. The Procuring Entity will select one Option of the two Options listed below for award of Contracts.

OPTION 1

i) If a tenderer wins only one Lot, the tenderer will be awarded a contract for that Lot, provided the tenderer meets the Eligibility and Qualification Criteria for that Lot.

ii) If a tenderer wins more than one Lot, the tender will be awarded contracts for all won Lots, provided the tenderer meets the aggregate Eligibility and Qualification Criteria for all the Lots. The tenderer will be awarded the combination of Lots for which the tenderer qualifies and the others will be considered for award to second lowest the tenderers.

OPTION 2

The Procuring Entity will consider all possible combinations of won Lots [contract(s)] and determine the combinations with the lowest evaluated price. Tenders will then be awarded to the Tenderer or Tenderers in the combinations provided the tenderer meets the aggregate Eligibility and Qualification Criteria for all the won Lots.

5. **Alternative Tenders (ITT 13.1)**

An alternative if permitted under ITT 13.1, will be evaluated as follows:

The Procuring Entity shall consider Tenders offered for alternatives as specified in Part 2- Works Requirements. Only the technical alternatives, if any, of the Tenderer with the Best Evaluated Tender conforming to the basic technical requirements shall be considered by the Procuring Entity.

6. **Margin of Preference** is not applicable

7. **Post qualification and Contract ward (ITT 39), more specifically,**

a) In case the tender was subject to post-qualification, the contract shall be awarded to the lowest evaluated tenderer, subject to confirmation of pre-qualification data, if so required.

b) In case the tender was not subject to post-qualification, the tender that has been determined to be the lowest evaluated tenderer shall be considered for contract award, subject to meeting each of the following conditions.

i) The Tenderer shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow of Kenya Shillings **40,000,000**

ii) Minimum average annual construction turnover of Kenya Shillings **150,000,000**, equivalent calculated as total certified payments received for contracts in progress and/or completed within three

years.

iii) At least **one** of contract(s) of a similar nature executed within Kenya, or the East African Community or abroad, that have been satisfactorily and substantially completed as a prime contractor, or joint venture member or sub-contractor each of minimum value Kenya shillings **100, 000,000** equivalent.

iv) Contractor's Representative and Key Personnel, which are specified as, **below**

No.	Position	Minimum Qualifications	Experience in Similar Works (years)
1.	Contractor's Representative / Site Agent- One (1 Nr)	• Degree in Civil or Water Engineering or equivalent or • Higher Diploma in Civil or Water Engineering or equivalent or	5
2.	Surveyor- One (1 Nr)	• Diploma in Survey or equivalent	5
3.	General Foreman (1No)	• Diploma in Civil or Water Engineering	5
4.	Clerk of Works (1 No)	• Diploma in Civil or Water Engineering or • Construction Technician Course	5
5.	Power Plant Mechanic (1)	• Diploma in Mechanical Engineering (Plant Option	5
6.	Plumber -	• Certificate in plumbing	5

CVs (including academic and professional certificates of proposed Personnel
The Bidder shall provide further details of proposed items of personnel using the relevant Form

v) Contractors key equipment listed on the table below;-

No.	Equipment Type and Characteristics	Minimum Number required
1	Hydraulic Excavator	Two (2)
2	Roller	Two (2)
3	Back hoe Excavator	One (1)
4	Wheeled Shovel/Loader	One (1)
5	HDPE pipe Butt Fusion Equipment	One (1)
6	15-ton Tipper Lorry	Four (4)
7	7 / 10 / 15-ton Lorry	One (1)
8	4WD Pick-Up – 1 Ton	One (1)
9	Concrete Mixers (capacity $0.3m^3$ to$1m^3$)	One (1)

Documentary evidence through logo books containing tenderers name for owned equipment's/ or logo books containing lessee name for leased equipment's- certified by commissioner of oath
The Bidder shall provide further details of proposed item s of equipment using the relevant Form

vi) Other conditions depending on their seriousness.

a) **History of non-performing contracts**:
Tenderer and each member of JV in case the Tenderer is a JV, shall demonstrate that Non-performance of a contract did not occur because of the default of the Tenderer, or the member of a JV in the last **three years**. The required information shall be furnished in the appropriate form.

b) **Pending Litigation**
Financial position and prospective long-term profitability of the Single Tenderer, and in the

case the Tenderer is a JV, of each member of the JV, shall remain sound according to criteria established with respect to Financial Capability under Paragraph (i) above if all pending litigation will be resolved against the Tenderer. Tenderer shall provide information on pending litigations in the appropriate form.

c) Litigation History

There shall be no consistent history of court/arbitral award decisions against the Tenderer, in the last **three years**. All parties to the contract shall furnish the information in the appropriate form about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the years specified. A consistent history of awards against the Tenderer or any member of a JV may result in rejection of the tender.

8. QUALIFICATION FORM SUMMARY

1	2	3	*4*	*5*
Item No.	**Qualification Subject**	**Qualification Requirement**	***Document To be Completed by Tenderer***	***NWWDA Qualification Assessment- met or Not Met)***
1	Nationality	Nationality in accordance with ITT 3.6	Forms ELI – 1.1 and 1.2, with attachments	
2	Tax Obligations for Kenyan Tenderers	Has produced a current tax clearance certificate or tax exemption certificate issued by the the Kenya Revenue Authority in accordance with ITT 3.14.	Form of Tender	
3	Conflict of Interest	No conflicts of interest in accordance with ITT 3.3	Form of Tender	
4	PPRA Eligibility	Not having been declared ineligible by the PPRA as described in ITT 3.8	Form of Tender	
5	State- owned Enterprise	Meets conditions of ITT 3.7	Forms ELI – 1.1 and 1.2, with attachments	
6	Goods, equipment and services to be supplied under the contract	To have their origin in any country that is not determined ineligible under ITT 4.1	Forms ELI – 1.1 and 1.2, with attachments	
7	History of Non-Performing Contracts	Non-performance of a contract did not occur as a result of contractor default since **1st January 2020**	Form CON-2	
8	Suspension Based on Execution of Tender/Proposal Securing Declaration by the Procuring Entity	Not under suspension based on-execution of a Tender/Proposal Securing Declaration pursuant to ITT 19.9	Form of Tender	
9	Pending Litigation	Tender's financial position and prospective long-term profitability still sound according to criteria established in 3.1 and assuming that all pending litigation will NOT be resolved against the Tenderer.	Form CON – 2	
10	Litigation History	No consistent history of court/arbitral award decisions against the Tenderer since **1st January *2020***	Form CON – 2	
11	Financial Capabilities	(i) The Tenderer shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as Kenya Shillings ***40,000,000*** equivalent for the subject contract(s) net of the Tenderer's other commitments. (ii) The Tenderers shall also demonstrate, to the satisfaction of the Procuring Entity, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.	Form FIN – 3.1, with attachments	

1	2	3	*4*	*5*
Item No.	**Qualification Subject**	**Qualification Requirement**	***Document To be Completed by Tenderer***	***NWWDA Qualification Assessment- met or Not Met)***
		(iii) The audited balance sheets or, if not required by the laws of the Tenderer's country, other financial statements acceptable to the Procuring Entity, for the last *three* years- **(2020, 2021, 2022)** shall be submitted and must demonstrate the current soundness of the Tenderer's financial position and indicate its prospective long-term profitability.		
12	Average Annual Construction Turnover	Minimum average annual construction turnover of Kenya Shillings **15*0,000,000*** equivalent calculated as total certified payments received for contracts in progress and/or completed within the last *three* years, divided by *three* years	Form FIN – 3.2	
13	General Construction Experience	Experience under construction contracts in the role of prime contractor, JV member, sub-contractor, or management contractor for at least the last ***three* years**, **starting 1st January *2020***	**4.** Form EXP – 4.1 **Experience**	
14	Specific Construction & Contract Management Experience	A minimum number of ***one*** similar contract specified below that have been satisfactorily and substantially completed as a prime contractor, joint venture member, management contractor or sub-contractor between **1st January 2020** and tender submission deadline i.e. **. one** contract, each of minimum value Kenya shillings **100,000,000** equivalent. The similarity of the contracts shall be based on the following: **a. Excavation of at least 200,000m^3 of Soil in various material per year.** **b. Compacting of 70,000m^3 of Earth Embankment** **c. Carting away of at least 200,000m^3 of the Excavated material to spoil to Embankment and or spoil** **d. Construction of the spillway** **e. Lining of the Dam with Rip rap as appropriate** **f. Construction of a 75mm dia 2.4km long of HDPE PN 10 Rising main** **g. Installation of at least 10m^3 of Plastic Tank on a**	Form EXP 4.2(a)	

1	2	3	*4*	*5*
Item No.	**Qualification Subject**	**Qualification Requirement**	***Document To be Completed by Tenderer***	***NWWDA Qualification Assessment- met or Not Met)***
		steel Girder **h. Purchase and installation of Solar, a pump and other related electro mechanical equipment including wiring** **i. Fencing with concrete posts and chain-link of approximately 1,500m long per year** ***The agency will verify the information, if found untrue, it will lead to disqualification of the bid***		

QUALIFICATION FORMS

1. FORM EQU: EQUIPMENT

The Tenderer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Tenderer.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Tenderer.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

2. FORM PER -1

Contractor's Representative and Key Personnel Schedule

Tenderers should provide the names and details of the suitably qualified Contractor's Representative and Key Personnel to perform the Contract. The data on their experience should be supplied using the Form PER-2 below for each candidate.

Contractor' Representative and Key Personnel

1.	**Title of position: Contractor's Representative**	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
2.	**Title of position:** *[_____]*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
3.	**Title of position:** *[_____]*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
4.	**Title of position:** *[_____]*	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
5.	**Title of position:** *[insert title]*	
	Name of candidate	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]

3. FORM PER-2:

Resume and Declaration - Contractor's Representative and Key Personnel.

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

Name of Tenderer

Position [*#1*]: [*title of position from Form PER-1*]		
Personnel information	Name:	Date of birth:
	Address:	E-mail:
	Professional qualifications:	
	Academic qualifications:	
	Language proficiency: *[language and levels of speaking, reading and writing skills]*	
Details		
	Address of Procuring Entity:	
	Telephone:	Contact (manager / personnel officer):
	Fax:	
	Job title:	Years with present Procuring Entity:

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

Project	**Role**	**Duration of involvement**	**Relevant experience**
[main project details]	*[role and responsibilities on the project]*	*[time in role]*	*[describe the experience relevant to this position]*

Declaration

I, the undersigned *[insert either "Contractor's Representative" or "Key Personnel" as applicable]*, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

I confirm that I am available as certified in the following table and throughout the expected time schedule for this position as provided in the Tender:

Commitment	**Details**
Commitment to duration of contract:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*
Time commitment:	*[insert period (start and end dates) for which this Contractor's Representative or Key Personnel is available to work on this contract]*

I understand that any misrepresentation or omission in this Form may:

a) be taken into consideration during Tender evaluation;
b) result in my disqualification from participating in the Tender;
c) result in my dismissal from the contract.

Name of Contractor's Representative or Key Personnel: [*insert name*]

Signature: _____

Date: (day month year): _____ Countersignature

of authorized representative of the Tenderer:

Signature:_____ Date: (day month

year): _____

4. TENDERER'S QUALIFICATION WITHOUT PRE-QUALIFICATION

To establish its qualifications to perform the contract in accordance with Section III, Evaluation and Qualification Criteria the Tenderer shall provide the information requested in the corresponding Information Sheets included hereunder.

4.1 FORM ELI -1.1

Tenderer Information Form

Date: _____

ITT No. and title: _____

Tenderer's name
In case of Joint Venture (JV), name of each member:
Tenderer's actual or intended country of registration: *[indicate country of Constitution]*
Tenderer's actual or intended year of incorporation:
Tenderer's legal address [in country of registration]:
Tenderer's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITT 3.6 ☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITT 3.5 ☐ In case of state-owned enterprise or institution, in accordance with ITT 3.8, documents establishing: • Legal and financial autonomy • Operation under commercial law • Establishing that the Tenderer is not under the supervision of the Procuring Entity 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

4.2 FORM ELI -1.2

Tenderer's JV Information Form
(to be completed for each member of Tenderer's JV)
Date: _____

ITT No. and title: _____

Tenderer's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITT 3.6. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Procuring Entity, in accordance with ITT 3.8. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

4.3 FORM CON – 2

Historical Contract Non-Performance, Pending Litigation and Litigation History

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. ☐ Contract(s) not performed since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1			
Year	**Non- performed portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and Kenya Shilling equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Procuring Entity: *[insert full name]* Address of Procuring Entity: *[insert street/city/country]* Reason(s) for nonperformance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3. ☐ Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below.			

Year of dispute	**Amount in dispute (currency)**	**Contract Identification**	**Total Contract Amount (currency), Kenya Shilling Equivalent (exchange rate)**
		Contract Identification: _____ Name of Procuring Entity: _____ Address of Procuring Entity: _____ Matter in dispute: _____ Party who initiated the dispute: ____ Status of dispute: _____	
		Contract Identification: Name of Procuring Entity: Address of Procuring Entity: Matter in dispute: Party who initiated the dispute: Status of dispute:	
Litigation History in accordance with Section III, Evaluation and Qualification Criteria			
☐ No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4. ☐ Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below.			
Year of award	**Outcome as percentage of Net Worth**	**Contract Identification**	**Total Contract Amount (currency), Kenya Shilling**

			Equivalent (exchange rate)
[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Procuring Entity: *[insert full name]* Address of Procuring Entity: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Procuring Entity" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*

4.4 FORM FIN – 3.1:

Financial Situation and Performance

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

4.4.1. Financial Data

Type of Financial information in_____ (currency)	**Historic information for previous _____*years*, _____ (amount in currency, currency, exchange rate*, USD equivalent)**				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Statement of Financial Position (Information from Balance Sheet)					
Total Assets (TA)					
Total Liabilities (TL)					
Total Equity/Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Working Capital (WC)					
Information from Income Statement					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Cash Flow Information					
Cash Flow from Operating Activities					

*Refer to ITT 15 for the exchange rate

4.4.2 Sources of Finance

Specify sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.

No.	Source of finance	Amount (Kenya Shilling equivalent)
1		
2		
3		

4.4.3 Financial documents

The Tenderer and its parties shall provide copies of financial statements for three (3*)* years pursuant to Section III, Evaluation and Qualifications Criteria, Sub-factor 3.1. The financial statements shall:

(a) reflect the financial situation of the Tenderer or in case of JV member, and not an affiliated entity (such as parent company or group member).

(b) be independently audited or certified in accordance with local legislation.

(c) be complete, including all notes to the financial statements.

(d) correspond to accounting periods already completed and audited.

☐ Attached are copies of financial statements[1] for the *_2018-2019,2019-2020,2020-2021* years required above; and complying with the requirements

[1] If the most recent set of financial statements is for a period earlier than 12 months from the date of Tender, the reason for this should be justified.

4.5 FORM FIN – 3.2:

Average Annual Construction Turnover

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

	Annual turnover data (construction only)		
Year	**Amount Currency**	**Exchange rate**	**Kenya Shilling equivalent**
[indicate year]	*[insert amount and indicate currency]*		
Average Annual Construction Turnover *			

* See Section III, Evaluation and Qualification Criteria, Sub-Factor 3.2.

4.6 FORM FIN – 3.3:

Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Section III, Evaluation and Qualification Criteria

Financial Resources		
No.	**Source of financing**	**Amount (Kenya Shilling equivalent)**
1		
2		
3		

4.7 FORM FIN – 3.4:

Current Contract Commitments / Works in Progress

Tenderers and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
	Name of Contract	**Procuring Entity's Contact Address, Tel,**	**Value of Outstanding Work [Current Kenya Shilling /month Equivalent]**	**Estimated Completion Date**	**Average Monthly Invoicing Over Last Six Months [Kenya Shilling /month)]**
1					
2					
3					
4					
5					

4.8 FORM EXP - 4.1

General Construction Experience

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

Page _____of _____pages

Starting Year	Ending Year	Contract Identification	Role of Tenderer
		Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Procuring Entity: _____ Address: _____	
		Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Procuring Entity: _____ Address: _____	
		Contract name: _____ Brief Description of the Works performed by the Tenderer: _____ Amount of contract: _____ Name of Procuring Entity: _____ Address: _____	

4.9 FORM EXP - 4.2(a)

Specific Construction and Contract Management Experience

Tenderer's Name: _____
Date: _____
JV Member's Name_____
ITT No. and title: _____

Similar Contract No.	**Information**			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor ☐	Member in JV ☐	Management Contractor ☐	Sub-contractor ☐
Total Contract Amount			**Kenya Shilling**	
If member in a JV or sub-contractor, specify participation in total Contract amount				
Procuring Entity's Name:				
Address: Telephone/fax number E-mail:				

4.10 FORM EXP - 4.2 (a) (cont.)

Specific Construction and Contract Management Experience (cont.)

Similar Contract No.	**Information**
Description of the similarity in accordance with Sub-Factor 4.2(a) of Section III:	
1. Amount	
2. Physical size of required works items	
3. Complexity	
4. Methods/Technology	
5. Construction rate for key activities	
6. Other Characteristics	

4.11 FORM EXP - 4.2(b)

Construction Experience in Key Activities

Tenderer's Name: _____
Date: _____
Tenderer's JV Member Name: _____
Sub-contractor's Name[2] (as per ITT 34): _____
ITT No. and title: _____

All Sub-contractors for key activities must complete the information in this form as per ITT 34 and Section III, Evaluation and Qualification Criteria, Sub-Factor 4.2.

1. Key Activity No One: _ _____

	Information			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor ☐	Member in JV ☐	Management Contractor ☐	Sub-contractor ☐
Total Contract Amount			**Kenya Shilling**	
Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year	Total quantity in the contract (i)	Percentage participation (ii)		Actual Quantity Performed (i) x (ii)
Year 1				
Year 2				
Year 3				
Year 4				
Procuring Entity's Name:				
Address: Telephone/fax number E-mail:				

[2] If applicable

	Information
Description of the key activities in accordance with Sub-Factor 4.2(b) of Section III:	

2. Activity No. Two
3. ……

OTHER FORMS

5. FORM OF TENDER – (bidder Letter head must)

INSTRUCTIONS TO TENDERERS

i) The Tenderer must prepare this Form of Tender on stationery with its letterhead clearly showing the Tenderer's complete name and business address.

ii) All italicized text is to help Tenderer in preparing this form.

iii) Tenderer must complete and sign CERTIFICATE OF INDEPENDENT TENDER DETERMINATION and the SELF DECLARATION OF THE TENDERER attached to this Form of Tender.

iv) The Form of Tender shall include the following Forms duly completed and signed by the Tenderer.

- *Tenderer's Eligibility- Confidential Business Questionnaire*
- *Certificate of Independent Tender Determination*
- *Self-Declaration of the Tenderer*

Date of this Tender submission: *[insert date (as day, month and year) of Tender submission]*

Request for Tender No.: *[insert identification*]

Name and description of Tender *[Insert as per ITT)*

Alternative No.: [*insert identification No if this is a Tender for an alternative*]

To: [*insert complete name of Procuring Entity*] Dear Sirs,

1. In accordance with the Conditions of Contract, Specifications, Drawings and Bills of Quantities for the execution of the above named Works, we, the undersigned offer to construct and complete the Works and remedy any defects therein for the sum of Kenya Shillings [*[Amount in figures]*_____Kenya Shillings *[amount in words]*_____.

   The above amount includes foreign currency amount (s) of [*state figure or a percentage and currency*] [figures]_____[words]_____.

   The percentage or amount quoted above does not include provisional sums, and only allows not more than two foreign currencies.

2. We undertake, if our tender is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Project Manager's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Special Conditions of Contract.

3. We agree to adhere by this tender until_____*[Insert date],* and it shall remain binding upon us and may be accepted at any time before that date.

4. Unless and until a formal Agreement is prepared and executed this tender together with your written acceptance thereof, shall constitute a binding Contract between us. We further understand that you are not bound to accept the lowest or any tender you may receive.

5. We, the undersigned, further declare that:
   i) *No reservations:* We have examined and have no reservations to the tender document, including Addenda issued in accordance with ITT 28;
   ii) *Eligibility:* We meet the eligibility requirements and have no conflict of interest in accordance with ITT 3 and 4;
   iii) *Tender-Securing Declaration:* We have not been suspended nor declared ineligible by the Procuring Entity based on execution of a Tender-Securing or Proposal-Securing Declaration in the Procuring Entity's Country in accordance with ITT 19.8;
   iv) Conformity: We offer to execute in conformity with the tendering documents and in accordance with the implementation and completion specified in the construction schedule, the following Works: *[insert a brief description of the Works];*

   v) Tender Price: The total price of our Tender, excluding any discounts offered in item 1 above is: *[Insert one of*

the options below as appropriate]

vi Option 1, in case of one lot: Total price is: [*insert the total price of the Tender in words and figures, indicating the various amounts and the respective currencies*]; Or

Option 2, in case of multiple lots:

a) Total price of each lot [*insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies*]; and

b) Total price of all lots (sum of all lots) [*insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies*];

vii) *Discounts:* The discounts offered and the methodology for their application are:

viii) The discounts offered are: [*Specify in detail each discount offered.*]

ix) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

x) *Tender Validity Period:* Our Tender shall be valid for the period specified in TDS 18.1 (as amended, if applicable) from the date fixed for the Tender submission deadline specified in TDS 22.1 (as amended, if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

xi) *Performance Security:* If our Tender is accepted, we commit to obtain a Performance Security in accordance with the Tendering document;

xii) *One Tender Per Tender:* We are not submitting any other Tender(s) as an individual Tender, and we are not participating in any other Tender(s) as a Joint Venture member or as a subcontractor, and meet the requirements of ITT 3.4, other than alternative Tenders submitted in accordance with ITT 13.3;

xiii) *Suspension and Debarment:* We, along with any of our subcontractors, suppliers, Project Manager, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a temporary suspension or a debarment imposed by the Public Procurement Regulatory Authority or any other entity of the Government of Kenya, or any international organization.

xiv) *State-owned enterprise or institution:* [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITT 3.8*];

xv) *Commissions, gratuities, fees:* We have paid, or will pay the following commissions, gratuities, or fees with respect to the tender process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity].*

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

xvi) Binding Contract: We understand that this Tender, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

xvii) Not Bound to Accept: We understand that you are not bound to accept the lowest evaluated cost Tender, the Most Advantageous Tender or any other Tender that you may receive;

xviii) Fraud and Corruption: We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption;

xix) Collusive practices: We hereby certify and confirm that the tender is genuine, non-collusive and made with the intention of accepting the contract if awarded. To this effect we have signed the "Certificate of Independent Tender Determination" attached below.

xx) We undertake to adhere by the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal, copy available from_____(*specify website*) during the procurement process and the execution of any resulting contract.

xxi) We, the Tenderer, have completed fully and signed the following Forms as part of our Tender:

a) Tenderer's Eligibility; Confidential Business Questionnaire – to establish we are not in any conflict to interest.

b) Certificate of Independent Tender Determination – to declare that we completed the tender without colluding with other tenderers.

c) Self-Declaration of the Tenderer – to declare that we will, if awarded a contract, not engage in any form of fraud and corruption.

d) Declaration and commitment to the Code of Ethics for Persons Participating in Public Procurement and Asset Disposal

Further, we confirm that we have read and understood the full content and scope of fraud and corruption as informed in **"Appendix 1- Fraud and Corruption**" attached to the Form of Tender.

Name of the Tenderer: *[*insert complete name of person signing the Tender*]

Name of the person duly authorized to sign the Tender on behalf of the Tenderer: **[*insert complete name of person duly authorized to sign the Tender*]

Title of the person signing the Tender: [*insert complete title of the person signing the Tender*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown*

above] **Date signed** [*insert date of signing*] day of [*insert month*], [*insert year*]

Date signed_____day of_____, _____

Notes
** In the case of the Tender submitted by joint venture specify the name of the Joint Venture as Tenderer*
*** Person signing the Tender shall have the power of attorney given by the Tenderer to be attached with the Tender.*

A. TENDERER'S ELIGIBILITY- CONFIDENTIAL BUSINESS QUESTIONNAIRE

Instruction to Tenderer

Tender is instructed to complete the particulars required in this Form, *one form for each entity if Tender is a JV.* Tenderer is further reminded that it is an offence to give false information on this Form.

(a) **Tenderer's details**

	ITEM	DESCRIPTION
1	Name of the Procuring Entity	
2	Reference Number of the Tender	
3	Date and Time of Tender Opening	
4	Name of the Tenderer	
5	Full Address and Contact Details of the Tenderer.	1. Country 2. City 3. Location 4. Building 5. Floor 6. Postal Address 7. Name and email of contact person.
6	Current Trade License Registration Number and Expiring date	
7	Name, country and full address (*postal and physical addresses, email, and telephone number*) of Registering Body/Agency	
8	Description of Nature of Business	
9	Maximum value of business which the Tenderer handles.	
10	State if Tenders Company is listed in stock exchange, give name and full address (*postal and physical addresses, email, and telephone number*) of state which stock exchange	

General and Specific Details

b) Sole Proprietor, provide the following details.

Name in full_____Age_____ Nationality_ _____Country of Origin_____ Citizenship __ _____

c) Partnership, provide the following details.

	Names of Partners	Nationality	Citizenship	% Shares owned
1				
2				
3				

d) Registered Company, provide the following details.

i) Private or public Company_____

ii) State the nominal and issued capital of the Company_____

Nominal Kenya Shillings (Equivalent)..... Issued

Kenya Shillings (Equivalent).....

iii) Give details of Directors as follows.

	Names of Director	Nationality	Citizenship	% Shares owned
1				
2				
3				

(e) DISCLOSURE OF INTEREST- Interest of the Firm in the Procuring Entity.

i) Are there any person/persons in …… …… (*Name of Procuring Entity)* who has/have an interest or relationship in this firm? Yes/No……

If yes, provide details as follows.

	Names of Person	Designation in the Procuring Entity	Interest or Relationship with Tenderer
1			
2			
3			

ii) Conflict of interest disclosure

	Type of Conflict	Disclosure YES OR NO	If YES provide details of the relationship with Tenderer
1	Tenderer is directly or indirectly controls, is controlled by or is under common control with another tenderer.		
2	Tenderer receives or has received any direct or indirect subsidy from another tenderer.		
3	Tenderer has the same legal representative as another tenderer		
4	Tender has a relationship with another tenderer, directly or through common third parties that puts it in a position to influence the tender of another tenderer, or influence the decisions of the Procuring Entity regarding this tendering process.		
5	Any of the Tenderer's affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the tender.		
6	Tenderer would be providing goods, works, non-consulting services or consulting services during implementation of the contract specified in this Tender Document.		
7	Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who are directly or indirectly involved in the preparation of the Tender document or specifications of the Contract, and/or the Tender evaluation process of such contract.		
8	Tenderer has a close business or family relationship with a professional staff of the Procuring Entity who would be involved in the implementation or supervision of the such Contract.		
9	Has the conflict stemming from such relationship stated in item 7 and 8 above been resolved in a manner acceptable to the Procuring Entity throughout the tendering process and execution of the Contract.		

f) Certification

On behalf of the Tenderer, I certify that the information given above is complete, current and accurate as at the date of submission.

Full Name_____ Title or

Designation_____

_____ _____

(Signature) *(Date)*

B. CERTIFICATE OF INDEPENDENT TENDER DETERMINATION

I, the undersigned, in submitting the accompanying Letter of Tender to the_____[Name of Procuring Entity] for:_____[Name and number of tender] in response to the request for tenders made by:_____[Name of Tenderer] do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of_____[Name of Tenderer] that:

1. I have read and I understand the contents of this Certificate;

2. I understand that the Tender will be disqualified if this Certificate is found not to be true and complete in every respect;

3. I am the authorized representative of the Tenderer with authority to sign this Certificate, and to submit the Tender on behalf of the Tenderer;

4. For the purposes of this Certificate and the Tender, I understand that the word "competitor" shall include any individual or organization, other than the Tenderer, whether or not affiliated with the Tenderer, who:
   a) has been requested to submit a Tender in response to this request for tenders;
   b) could potentially submit a tender in response to this request for tenders, based on their qualifications, abilities orexperience;

5. The Tenderer discloses that [check one of the following, as applicable:
   a) The Tenderer has arrived at the Tender independently from, and without consultation, communication, agreement or arrangement with, any competitor;
   b) the Tenderer has entered into consultations, communications, agreements or arrangements with one or more competitors regarding this request for tenders, and the Tenderer discloses, in the attached document(s), complete details thereof, including the names of the competitors and the nature of, and reasons for, such consultations, communications, agreements or arrangements;

6. In particular, without limiting the generality of paragraphs (5)(a) or (5)(b) above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
   a) prices;
   b) methods, factors or formulas used to calculate prices;
   c) the intention or decision to submit, or not to submit, a tender; or
   d) the submission of a tender which does not meet the specifications of the request for Tenders; except as specifically disclosed pursuant to paragraph (5)(b) above;

7. In addition, there has been no consultation, communication, agreement or arrangement with any competitor regarding the quality, quantity, specifications or delivery particulars of the works or services to which this request for tenders relates, except as specifically authorized by the procuring authority or as specifically disclosed pursuant to paragraph (5)(b) above;

8. the terms of the Tender have not been, and will not be, knowingly disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official tender opening, or of the awarding of the Contract, whichever comes first, unless otherwise required by law or as specifically disclosed pursuant to paragraph (5)(b) above.

Name_____ Title__ Date _____

[Name, title and signature of authorized agent of Tenderer and Date].

C. SELF - DECLARATION FORMS

FORM SD1

SELF DECLARATION THAT THE PERSON/TENDERER IS NOT DEBARRED IN THE MATTER OF THE PUBLIC PROCUREMENTAND ASSET DISPOSALACT 2015.

I, ……., of Post Office Box …….……. being a resident of …….. in the Republic of ……. do hereby make a statement as follows: -

1. THAT I am the Company Secretary/ Chief Executive/Managing Director/Principal Officer/Director of ……...…….. *(insert name of the Company)* who is a Bidder in respect of Tender No. …….. for ……. *(insert tender title/description)* for ……. *(insert name of the Procuring entity)* and duly authorized and competent to make this statement.

2. THAT the aforesaid Bidder, its Directors and subcontractors have not been debarred from participating in procurement proceeding under Part IV of the Act.

3. THAT what is deponed to herein above is true to the best of my knowledge, information and belief.

……. ……. …… (Title)
(Signature) (Date)

Bidder Official Stamp

FORM SD2

SELF DECLARATION THAT THE PERSON/TENDERER WILL NOT ENGAGE IN ANY CORRUPT OR FRAUDULENT PRACTICE

I, ……. of P. O. Box …….....…….. being a resident of …….. in the Republic of ……. do hereby make a statement as follows: -

1. THAT I am the Chief Executive/Managing Director/Principal Officer/Director of ……..... *(insert name of the Company)* who is a Bidder in respect of Tender No. ….....……. for …….. *(insert tender title/description)* for …… *(insert name of the Procuring entity)* and duly authorized and competent to make this statement.

2. THAT the aforesaid Bidder, its servants and/or agents /subcontractors will not engage in any corrupt or fraudulent practice and has not been requested to pay any inducement to any member of the Board, Management, Staff and/or employees and/or agents of ……... *(insert name of the Procuring entity)* which is the procuring entity.

3. THAT the aforesaid Bidder, its servants and/or agents /subcontractors have not offered any inducement to any member of the Board, Management, Staff and/or employees and/or agents of ……. (name of the procuring entity)

4. THAT the aforesaid Bidder will not engage /has not engaged in any corrosive practice with other bidders participating in the subject tender

5. THAT what is deponed to herein above is true to the best of my knowledge information and belief.

……	……..……	.....……
(Title)	(Signature)	(Date)

Bidder's Official Stamp

DECLARATION AND COMMITMENT TO THE CODE OF ETHICS

I ……..……. (person) on behalf of *(Name of the Business/ Company/Firm*) ……. declare that I have read and fully understood the contents of the Public Procurement & Asset Disposal Act, 2015, Regulations and the Code of Ethics for persons participating in Public Procurement and Asset Disposal and my responsibilities under the Code.

I do hereby commit to abide by the provisions of the Code of Ethics for persons participating in Public Procurement and Asset Disposal.

Name of Authorized signatory……..... Sign…….....

Position…….....…….....

Office address……. Telephone…….....…….

E-mail…….....….....…

Name of the Firm/Company…….....……

Date…….....…. (Company Seal/ Rubber

Stamp where applicable)

Witness

Name ……..... Sign.....

Date……

D. APPENDIX 1- FRAUD AND CORRUPTION

(Appendix 1 shall not be modified)

1. Purpose

The Government of Kenya's Anti-Corruption and Economic Crime laws and their sanction's policies and procedures, Public Procurement and Asset Disposal Act *(no. 33 of 2015)* and its Regulation, and any other Kenya's Acts or Regulations related to Fraud and Corruption, and similar offences, shall apply with respect to Public Procurement Processes and Contracts that are governed by the laws of Kenya.

2. Requirements

The Government of Kenya requires that all parties including Procuring Entities, Tenderers, (applicants/proposers), Consultants, Contractors and Suppliers; any Sub-contractors, Sub-consultants, Service providers or Suppliers; any Agents (whether declared or not); and any of their Personnel, involved and engaged in procurement under Kenya's Laws and Regulation, observe the highest standard of ethics during the procurement process, selection and contract execution of all contracts, and refrain from Fraud and Corruption and fully comply with Kenya's laws and Regulations as per paragraphs 1.1 above.

Kenya's public procurement and asset disposal act *(no. 33 of 2015)* under Section 66 describes rules to be followed and actions to be taken in dealing with Corrupt, Coercive, Obstructive, Collusive or Fraudulent practices, and Conflicts of Interest in procurement including consequences for offences committed. A few of the provisions noted below highlight Kenya's policy of no tolerance for such practices and behavior: -

1) a person to whom this Act applies shall not be involved in any corrupt, coercive, obstructive, collusive or fraudulent practice; or conflicts of interest in any procurement or asset disposal proceeding;
2) A person referred to under subsection (1) who contravenes the provisions of that sub-section commits an offence;
3) Without limiting the generality of the subsection (1) and (2), the person shall be: -
   a) disqualified from entering into a contract for a procurement or asset disposal proceeding; or
   b) if a contract has already been entered into with the person, the contract shall be voidable;
4) The voiding of a contract by the procuring entity under subsection (7) does not limit any legal remedy the procuring entity may have;
5) An employee or agent of the procuring entity or a member of the Board or committee of the procuring entity who has a conflict of interest with respect to a procurement: -
   a) shall not take part in the procurement proceedings;
   b) shall not, after a procurement contract has been entered into, take part in any decision relating to the procurement or contract; and

c) shall not be a subcontractor for the bidder to whom was awarded contract, or a member of the group of bidders to whom the contract was awarded, but the subcontractor appointed shall meet all the requirements of this Act.

6) An employee, agent or member described in subsection (1) who refrains from doing anything prohibited under that subsection, but for that subsection, would have been within his or her duties shall disclose the conflict of interest to the procuring entity;
7) If a person contravenes subsection (1) with respect to a conflict of interest described in subsection (5)(a) and the contract is awarded to the person or his relative or to another person in whom one of them had a direct or indirect pecuniary interest, the contract shall be terminated and all costs incurred by the public entity shall be made good by the awarding officer. Etc.

In compliance with Kenya's laws, regulations and policies mentioned above, the Procuring Entity:

a) Defines broadly, for the purposes of the above provisions, the terms set forth below as follows:
   i) "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
   ii) "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;

iii) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

iv) "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

v) "obstructive practice" is:

- deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede investigation by Public Procurement Regulatory Authority (PPRA) or any other appropriate authority appointed by Government of Kenya into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or
- acts intended to materially impede the exercise of the PPRA's or the appointed authority's inspection and audit rights provided for under paragraph 2.3 e. below.

b) Defines more specifically, in accordance with the above procurement Act provisions set forth for fraudulent and collusive practices as follows:

"fraudulent practice" includes a misrepresentation of fact in order to influence a procurement or disposal process or the exercise of a contract to the detriment of the procuring entity or the tenderer or the contractor, and includes collusive practices amongst tenderers prior to or after tender submission designed to establish tender prices at artificial non-competitive levels and to deprive the procuring entity of the benefits of free and open competition.

c) Rejects a proposal for award[1] of a contract if PPRA determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;

d) Pursuant to the Kenya's above stated Acts and Regulations, may sanction or recommend to appropriate authority (ies) for sanctioning and debarment of a firm or individual, as applicable under the Acts and Regulations;

e) Requires that a clause be included in Tender documents and Request for Proposal documents requiring (i) Tenderers (applicants/proposers), Consultants, Contractors, and Suppliers, and their Sub-contractors, Sub-consultants, Service providers, Suppliers, Agents personnel, permit the PPRA or any other appropriate authority appointed by Government of Kenya to inspect[2] all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the PPRA or any other appropriate authority appointed by Government of Kenya; and

f) Pursuant to Section 62 of the above Act, requires Applicants/Tenderers to submit along with their Applications/Tenders/Proposals a "Self-Declaration Form" as included in the procurement document declaring that they and all parties involved in the procurement process and contract execution have not engaged/will not engage in any corrupt or fraudulent practices.

---

[1] *For the avoidance of doubt, a party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and tendering, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.*

[2] *Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Investigating Authority or persons appointed by the Procuring Entity to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.*

FORM OF TENDER SECURITY-[Option 1–Demand Bank Guarantee]

Beneficiary:_____

Request forTenders No:

_____

Date:_____

TENDER GUARANTEE No.:_____

Guarantor: _____

1. We have been informed that_____(here inafter called "the Applicant") has submitted or will submit to the Beneficiary its Tender (here in after called" the Tender") for the execution of_____ under Request for Tenders No._____(“The ITT”).

2. Furthermore, we understand that, according to the Beneficiary's conditions, Tenders must be supported by a Tender guarantee.

3. At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of_____(_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Applicant:

(a) has withdrawn its Tender during the period of Tender validity set forth in the Applicant's Letter of Tender (“the Tender Validity Period”), or any extension thereto provided by the Applicant; or

b) having been notified of the acceptance of its Tender by the Beneficiary during the Tender Validity Period or any extension there to provided by the Applicant, (i) has failed to execute the contract agreement, or (ii) has failed to furnish the Performance.

4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii) thirty days after the end of the Tender Validity Period.

5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above onor before that date.

_____

[signature(s)]

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

FORMAT OF TENDER SECURITY [Option 2–Insurance Guarantee]

TENDER GUARANTEE No.: _____

1. Whereas …… [*Name of the tenderer]* (hereinafter called "the tenderer") has submitted its tender dated …… [*Date of submission of tender]* for the …… *[Name and/or description of the tender]* (hereinafter called "the Tender") for the execution of_____under Request for Tenders No._____("the ITT").

2. KNOW ALL PEOPLE by these presents that WE …… of …… [**Name of Insurance Company**] having our registered office at …… (hereinafter called "the Guarantor"), are bound unto **Northern Water Works Development Agency** (hereinafter called "the Procuring Entity") in the sum of …… (Currency and guarantee amount) for which payment well and truly to be made to the said Procuring Entity, the Guarantor binds itself, its successors and assigns, jointly and severally, firmly by these presents.

   Sealed with the Common Seal of the said Guarantor this ___day of **_____ 2022 __**.

3. NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Applicant:

   a) has withdrawn its Tender during the period of Tender validity set forth in the Principal's Letter of Tender ("the Tender Validity Period"), or any extension thereto provided by the Principal; or

   b) having been notified of the acceptance of its Tender by the Procuring Entity during the Tender Validity Period or any extension thereto provided by the Principal; (i) failed to execute the Contract agreement; or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to tenderers ("ITT") of the Procuring Entity's Tendering document.

   then the guarantee undertakes to immediately pay to the Procuring Entity up to the above amount upon receipt of the Procuring Entity's first written demand, without the Procuring Entity having to substantiate its demand, provided that in its demand the Procuring Entity shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

4. This guarantee will expire: (a) if the Applicant is the successful Tenderer, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security and, or (b) if the Applicant is not the successful Tenderer, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Tendering process; or (ii)twenty-eight days after the end of the Tender Validity Period.

5. Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

_____	_____
[Date]	*[Signature of the Guarantor]*
_____	_____
[Witness]	*[Seal]*

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

TENDER-SECURING DECLARATION FORM

[The Bidder shall complete this Form in accordance with the instructions indicated]

Date:.....*[insert date (as day, month and year) of Tender Submission]*
Tender No.:.....*[insert number of tendering process]*
To:..... *[insert complete name of Purchaser]* I/We, the undersigned, declare that:

1. I/We understand that, according to your conditions, bids must be supported by a Tender-Securing Declaration.

2. I/We accept that I/we will automatically be suspended from being eligible for tendering in any contract with the Purchaser for the period of time of [insert number of months or years] starting on [insert date], if we are in breach of our obligation(s) under the bid conditions, because we – (a) have withdrawn our tender during the period of tender validity specified by us in the Tendering Data Sheet; or (b) having been notified of the acceptance of our Bid by the Purchaser during the period of bid validity, (i) fail or refuse to execute the Contract, if required, or (ii) fail or refuse to furnish the Performance Security, in accordance with the instructions to tenders.

3. I/We understand that this Tender Securing Declaration shall expire if we are not the successful Tenderer(s), upon the earlier of:
   a) our receipt of a copy of your notification of the name of the successful Tenderer; or
   b) thirty days after the expiration of our Tender.

4. I/We understand that if I am/we are/in a Joint Venture, the Tender Securing Declaration must be in the name of the Joint Venture that submits the bid, and the Joint Venture has not been legally constituted at the time of bidding, the Tender Securing Declaration shall be in the names of all future partners as named in the letter of intent.

Signed:……..……..….. Capacity / title (director or partner or sole proprietor, etc.) ……..…….....……. Name: …….. Duly authorized to sign the bid for and on behalf of: *[insert complete name of Tenderer]*

Dated on ……. day of ……..……. *[Insert date of signing]* Seal or stamp

Appendix to Tender

Schedule of Currency requirements

Summary of currencies of the Tender for_____*[insert name of Section of the Works]*

Name of currency	***Amounts payable***
Local currency: _____	
Foreign currency #1: _____	
Foreign currency #2: _____	
Foreign currency #3: _____	
Provisional sums expressed in local currency _____	[To be entered by the Procuring Entity]

PART II - WORK REQUIREMENTS

SECTION V – DRAWINGS

(TECHNICAL DRAWINGS PROVIDEDED SEPARATELY AS VOLUME II)

Water Pan Plan

SECTION VI – SPECIFICATIONS

PROVIDED AS A SEPARATE BOOKLET-VOLUME (III)

Bills of Quantities

Preamble to the Bills of Quantities

1. Day work Schedule

A Day work Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Procuring Entity of the realism of rates quoted by the Tenderers, the Day work Schedule should normally comprise the following:

a) A list of the various classes of labor, materials, and Constructional Plant for which basic day work rates or prices are to be inserted by the Tenderer, together with a statement of the conditions under which the Contractor shall be paid for work executed on a day work basis.

b) Nominal quantities for each item of day work, to be priced by each Tenderer at day work rates as Tender. The rate to be entered by the Tenderer against each basic day work item should include the Contractor's profit, overheads, supervision, and other charges.

2. Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary priced Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the Special Conditions of Contract should state the manner in which they shall be used, and under whose authority (usually the Project Manager's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Procuring Entity to select such specialized contractors. To provide an element of competition among the Tenderers in respect of any facilities, amenities, attendance, etc., to be provided by the successful Tenderer as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Tenderer to quote a sum for such amenities, facilities, attendance, etc.

These Notes for Preparing a Bill of Quantities are intended only as information for the Procuring Entity or the person drafting the tendering document. They should not be included in the final tendering document.

3. The Bills of Quantities

The Bills of Quantities should be divided generally into the following sections:

a) Preambles
b) Preliminary items
c) Work Items
c) Daywork Schedule;and
d) Provisional items
e) Summary.

4. The Summary to the Bills of Quantities will take this form or some other form but including these items.

	LESOIT WATER DAM PROJECT				
ITEM NO.	**DESCRIPTION**	**UNIT**	**QTY**	**RATE Kshs.**	**AMOUNT Kshs.**
	Bill No 1: Preliminaries and General Items				
1.1	Provide, install and maintain for the entire contract period a contract signboard as shown in contract drawings and to the satisfaction of the Engineer or his appointed Representative	Item	1		
	Contractors' campsite				
	Allow for establishment of the contractor's campsite	Sum	1		
	Insurance				
1.21	Loss of or damage to the Works, Plant, and Materials	Sum	1		
1.22	Personal injury or death of Workmen	Sum	1		
	Mobilisation				
1.31	Mobilisation of plant and equipment to the project site(s). Rate shall be inclusive of Demobilisation after completion of the works. Plant to include but not limited to the following: Excavator, Bulldozer, Roller, Water Bowser e.t.c	Sum	1		
	Community Work as part of CSR				
1.32	Removal of 20 tree stamp and reinstatement of ground as necessary and to the satisfaction of the Engineer	item	1		
	Resident Engineers office				
1.4	Allow for Renting or establishment of the Resident Engineers office	**Prov Sum**	**1**	**1,000,000**	**1,000,000**
	Attendance upon the Engineer's staff				
1.41	Allow for supervision, communication, accommodation for RE as Provisional Sum	**Months**	**6**	**150,000**	**900,000**
1.42	Ditto as above but Inspector of Works	**Months**	**6**	**80,000**	**480,000**
1.43	Ditto as above but 1 No. Driver	**Months**	**6**	**70,000**	**420,000**
1.44	Allow for Hiring of a-4 Wheeled Drive Double Cabin Vehicle for use by the Resident Engineer during construction period. The Vehicle must have high ground level clearance for rough terrain.	**Months**	**6**	**300,000**	**1,800,000**
1.45	Allow for Insurance, Fuel and Maintenance of the above Vehicle	**Months**	**6**	**200,000**	**1,200,000**
	Tests				
1.5	Allow for material testing as instructed by the Engineer	**Prov Sum**	**1**	**400,000**	**400,000**
1.6	**Design Review**				
1.7	Allow for Design review as instructed by the Engineer	**Prov Sum**	**1**	**400,000**	**400,000**
	Office Equipment				
1.8	Allow for purchase of office equipment as directed by the Engineer	**Prov Sum**	**1**	**800,000**	**800,000**
1.9	Allow for contractor's overheads &profits for items 1.41-1.8	%	**7,400,000**		
	Sub total for Preliminaries and General items				

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE Kshs.	AMOUNT Kshs.
2	**Bill No 2: PAN EXCAVATION & DAM CONSTRUCTION**				
	Site Clearance				
2.11	Clear reservoir area of all bushes, grass and shrubs including grabbing up roots and deposit away as directed by the engineer	m^2	40,000		
	Pan Excavation				
2.21	Excavate top soil in the reservoir area and below contour 1334m for depths of up 0.3m deep and cart away to spoil as directed by the Engineer	m^3	16,500		
2.22	Excavate in the reservoir area and below contour 1333.97m for depth not exceeding 1.0m and stockpile for re-use on the Dam embankment here below or to spoil around the Dam area as directed by the Engineer	m^3	43,500		
2.23	Excavate in the reservoir area for depths ranging between 1.0m and .0m and stockpile for re-use on the embankment as directed by the Engineer	m^3	20,000		
	Dam Embankment Construction				
2.31	Clear embankment of all loose rocks, bush and vegetation	m^2	2,250		
2.32	Strip top spill to an average depth of 0.3m over full area of embankment and stockpile or dispose as directed by the Engineer	m^3	3,900		
	Core trench				
2.33	Trench for the core (4m wide for the entire stretch of the dam) of normal material in bulk, stockpile or direct to fill	m^3	1,700		
	Embankment Filling				
2.34	Spread, trim and compact fill material to embankment, including all necessary haulage (within 200m), sorting and the specified addition of water provided in the below items	m^3	32,000		
2.34	Allow for water to be sourced within 2km radius	m^3	3,200		
2.35	Ditto as above but within 4km radius	m^3	3,200		
	Sub-Total for page carried forward to next page				

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE Kshs.	AMOUNT Kshs.
	Sub Total for Dam/Pan Carried Forward from Previous Pg				
	Silt Trap				
2.41	Excavate in normal soil to create the silt trap measuring 20m x 30m x2m deep as per the drawings and cart away to embankment and or spoil as shown in drawings and as directed by the Engineer	m^3	1,200		
	Inlet Channel and or cut of drains				
2.33	Excavate in normal soil to create the inflow channel and or cut of drain as per the drawings and cart away to spoil	m^3	600		
	Supply materials, cut to recess and construct weighted Gabion mattress 6mx1mx0.3m as riprap at inlet to pan	No	3		
	Outlet Channel/Spillway				
2.42	Excavate in normal soil to create the outlet channel/spillway as per the drawings and cart away to spoil	m^3	150		
	Concrete Sill				
2.43	Construct a concrete sill (Mix 1:2:4) at the inlet to outflow channel (0.5mx0.3mx20m)	m^3	3		
	Gabions				
2.42	Provide materials and construct weighted Gabion mattress as riprap materials at overflow sill	m^3	40		
	Riprap				
2.43	Provide Riprap protection for the silt trap inlet walls, Reservoir inlet walls and outflow channel/spillway as shown in Drawings. Provisional	m^2	200		
2.44	Provide Riprap protection on the face of the Dam facing the reservoir as directed	m^2	600		
	Sub-Total for Dam/Pan carried forward to summary page				

ITEM NO.	DESCRIPTION	UNIT	QTY	RATE Kshs.	AMOUNT Kshs.
	Bill No 3: Intake/Pumping works				
	Intake/Floating Pontoon				
3.10	Provide material and fabricate a Floating pontoon to anchor the water intake/pump on the surface of water	Sum	1		
	Electro-Mechanical Works and Solar Equipment				
3.20	330 Watts Crystalline Solar Modules/Panels to specifications and acceptable to the Engineer	Watts	5,000		
3.30	Solar Pumping control panel/inverter	No	1		
	Pump				
3.40	Allow for supply and installation of a submersible pump or surface pump with **flow Q=8m^3/hr, Total Pumping Head, H=30, (Provisional)**	**Prov sum**	**1**		
	Automated Controls for pumping				
3.50	Allow for purchase and installation of a float switch in the Tank	sum	1		
	Cabling and connection				
3.60	Allow for cabling and sundries	**Prov sum**	**1**		
3.70	Allow for contractor's profits and overheads	%	**650,000**		
	Solar Support structures				
3.80	Provide and install a 4m high solar support structure for the 15 control panels above	No	1		
	Sub total for Intake/Pumping works				

Item No.	Description	Unit	Qty	Rate (Kshs)	Amount (Kshs)
	BILL NO. 4 - RISING MAINS *Refer to the Rising mains dwg*				
	Site Clearance				
F1.01	General clearance along pipeline route	m	2,400		
	Trench Excavation				
F2.01	Trench for 63-110 mm ND HDPE Pipes for depth N.E. 1.0M	m	2,400		
	Pipework *Supply and install the following. The cost should include required fitting and joinery material*				
F3.01	75mm diameter HDPE PN 10 HDPE pipe in compliance with AWWA Specifications C906.	m	2,400		
F3.02	Provide for fusion of Joints for the entire length above	Lump sum	1		
	Valves				
F4.01	25 mm flanged single air valve PN 10 fitted to 63mm diameter HDPE Main. Include all the required Fittings	nr	1		
	63mm diameter Valve Sockets	Nr	16		
	<u>Wash outs</u>				
F5.01	32 mm. DN GI washout fitted on 63mm diameter HDPE pipe main. The outfall for scour to be HDPE as per relevant drawing	nr	2		
	Gate Valves				
F6.01	50mm diameter Gate Valve. Include all the required Fittings like adaptors etc.	nr	4		
	<u>Valve Chambers</u> *For valve chamber detail refer to relevant drg STD No 017-TYPE-003 Sheets 1 to 4*				
F7.01	Valve chamber type 3 depth n.e. l.0m	nr	10		
F7.02	Valve chamber type 2 depth n.e. 1.0 m	nr	4		
	Sub total for the Rising Main				

Item No.	Description	Unit	Qty	Rate (Kshs)	Amount (Kshs)
	BILL NO 5. -REHABILITATION OF EXISTING KIOSKS & STORAGE TANKS				
5.1	Allow for smooth mortar finish of the existing 2No Kiosk walls, slab and floors.	m^2	120		
	Paints				
	Provide and apply the following paints to specifications				
D6.03	Include red oxide powder	m^2	10		
D6.04	Red oxide floor polish	m^2	10		
D6.05	Emulsion paints	m^2	90		
D6.06	Enamel paints	m^2	80		
	Plumbing & Pipe Fitting				
D7.19	Allow for connection of Water Kiosk to the new 75/65mm Water Distribution Pipeline	Item	1		
	PVC Tank mounted over R. C. Roof Slab of WK				
D8.01	Purchase and Installation of plastic tank 10,000 Liters on the roof slab of the water kiosk as shown in the drawings	Nr	2		
	Sub Total for Rehabilitation of 2Nre Water Kiosk with Tank on Roof slab to summary page				

Item No.	Description	Unit	Qty	Rate (Kshs)	Amount (Kshs)
	BILL NO 6- 10m^3 PLASTIC STORAGE ON A 9m HIGH FABRICATED STEEL GIRDER				
	Earth works, concrete works and Tank construction to be done in line with EST drawing number NWWDA/WSDP/002				
	EXCAVATION AND EARTHWORKS				
6.11	Excavate in any material for tank tower foundation spread and level the excavated materials and stack surplus for re-use as directed	m³	2		
6.12	Spread and level on site as directed or dispose of surplus material	m³	5		
6.13	Trim, spread and level the ground around tank to form suitable drainage of surface water	m³	3		
	TANK CONSTRUCTION				
6.21	Supply and place reinforced concrete 1: 2: 4 as foundation for tank tower. Rate to include for reinforcement bars for the foundation as necessary	m³	2		
6.22	Allow for compliance to other foundation requirements as recommended by the manufacturer	Sum	1		
6.23	Supply all materials, tools and equipment fabricate and erect a 9m high steel Girder to hoist a 10m^3 Plastic Tank. Allow for ladder and walkway with walkway guard.	No	1		
	PIPES AND SPECIALS				
6.31	Allow for pipework comprising of the 65mm diameter inflow, outflow and over flow inclusive of controls	Sum	1		
	PAINTING				
6.32	Allow for the complete installation to be painted as recommended by the engineer	Ls	1		
	PVC Tank mounted on a steel girder				
6.41	Purchase and Installation of plastic tank 10,000 Liters on the above Steel Girder	Nr	1		
	TESTING AND STERILISING				
6.51	Test and sterilize tank including the necessary chemicals	Ls	1		
	Sub Total for 10m3 Plastic Tank on Steel Girder to summary page				

Item No.	Description	Unit	Qty	Rate (Kshs)	Amount (Kshs)
	BILL NO. 7: FENCING				
	Fencing of The Water Pan/Dam				
7.1	Precast concrete posts 2.5-3.0m high	Nr	467		
7.2	Ditto above but bracing posts	Nr	60		
7.3	Chain-link 2.5-3.0 m high anchored on the ground	m	1,400		
7.4	Barbed wire heavy gauge	m	4,200		
7.5	Double wide gate 4m wide & accessories	No	1		
	Sub Total for fencing of Dam and solar components				

	BILLS COLLECTION SUMMARY				AMOUNT (KES)
	DESCRIPTION				**AMOUNT**
1	Preliminary and General Items				
2	Pan/Dam construction				
3	Intake, Solar and Pumping Works				
4	Rising Main				
5	Rehabilitation of 2No Water Kiosks and installation of $5m^3$ Plastic Tank on both				
6	Plastic Tank on Steel Girder				
7	Fencing of the Water Pan				
	Sub total for Works				
	Add 16% VAT				
	Add 5% Contingency				
	Grand Total				

PART III - CONDITIONS OF CONTRACT AND CONTRACT FORMS

SECTION VIII - GENERAL CONDITIONS OF CONTRACT

These General Conditions of Contract (GCC), read in conjunction with the Special Conditions of Contract (SCC) and other documents listed therein, should be a complete document expressing fairly the rights and obligations of both parties.

These General Conditions of Contract have been developed on the basis of considerable international experience in the drafting and management of contracts, bearing in mind a trend in the construction industry towards simpler, more straightforward language.

The GCC can be used for both smaller admeasurement contracts and lump sum contracts.

General Conditions of Contract

A. General

1. Definitions

1.1 Bold face type is used to identify defined terms.

a) **The Accepted Contract** Amount means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

b) **The Activity Schedule** is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works in a lump sum contract. It includes a lump sum price for each activity, which is used for valuations and for assessing the effects of Variations and Compensation Events.

c) **The Adjudicator** is the person appointed jointly by the Procuring Entity and the Contractor to resolve disputes in the first instance, as provided for in GCC 23.

d) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.

e) **Compensation Events** are those defined in GCC Clause 42 hereunder.

f) **The Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC Sub-Clause 53.1.

g) **The Contract** is the Contract between the Procuring Entity and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC Sub-Clause 2.3 below.

h) **The Contractor** is the party whose Bid to carry out the Works has been accepted by the Procuring Entity.

i) **The Contractor's Bid** is the completed bidding document submitted by the Contractor to the Procuring Entity.

j) **The Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.

k) **Days** are calendar days; months are calendar months.

l) **Day work**s are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant.

m) **A Defect** is any part of the Works not completed in accordance with the Contract.

n) **The Defects** Liability Certificate is the certificate issued by Project Manager upon correction of defects by the Contractor.

o) **The Defects Liability Period** is the period **named in the SCC** pursuant to Sub-Clause 34.1 and calculated from the Completion Date.

p) **Drawings** means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Procuring Entity in accordance with the Contract, include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

q) **The Procuring Entity** is the party who employs the Contractor to carry out the Works, **as specified in the SCC,** who is also the Procuring Entity.

r) **Equipmen**t is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

s) **"In writing" or "written"** means hand-written, type-written, printed or electronically made, and

resulting in a permanent record;

t) The Initial Contract Price is the Contract Price listed in the Procuring Entity's Letter of Acceptance.

u) **The Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is **specified in the SCC**. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

v) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.

w) **Plant i**s any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

x) **The Project Manager** is the person **named in the SCC** (or any other competent person appointed by the Procuring Entity and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract.

y) **SCC** means Special Conditions of Contract.

z) **The Site** is the area of the works as **defined as such in the SCC**.

aa) **Site Investigation Reports** are those that were included in the bidding document and are factual and interpretative reports about the surface and subsurface conditions at the Site.

bb) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

cc) **The Start Date** is **given in the SCC**. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

dd) **A Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.

ee) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.

ff) **A Variation** is an instruction given by the Project Manager which varies the Works.

gg) **The Works** are what the Contract requires the Contractor to construct, install, and turn over to the Procuring Entity, **as defined in the SCC**.

2. Interpretation

2.1 In interpreting these GCC, words indicating one gender include all genders. Words indicating the singular also include the plural and words indicating the plural also include the singular. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.

2.2 If sectional completion is specified in the SCC, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

a) Agreement,
b) Letter of Acceptance,
c) Contractor's Bid,
d) Special Conditions of Contract,
e) General Conditions of Contract, including Appendices,
f) Specifications,
g) Drawings,
h) Bill of Quantities[6], and
i) any other document **listed in the SCC** as forming part of the Contract.

[6] *In lump sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule."*

3. Language andLaw

3.1 The language of the Contract is English Language and the law governing the Contract are the Laws of Kenya.

3.2 Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in the Procuring Entity's Country when

a) as a matter of law or official regulations, Kenya prohibits commercial relations with that country; or

b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Kenya prohibits any import of goods from that country or any payments to any country, person, or entity in that country.

4. Project Manager's Decisions

4.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Procuring Entity and the Contractor in the role representing the Procuring Entity.

5. Delegation

5.1 Otherwise **specified in the SCC,** the Project Manager may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may revoke any delegation after notifying the Contractor.

6. Communications

6.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.

7. Subcontracting

7.1 The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Procuring Entity in writing. Subcontracting shall not alter the Contractor's obligations.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Procuring Entity between the dates given in the Schedule of Other Contractors, as **referred to in the SCC.** The Contractor shall also provide facilities and services for them as described in the Schedule. The Procuring Entity may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

9. Personnel andEquipment

9.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid, to carry out the Works or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.

9.2 If the Project Manager asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

9.3 If the Procuring Entity, Project Manager or Contractor determines, that any employee of the Contractor be determined to have engaged in Fraud and Corruption during the execution of the Works, then that employee shall be removed in accordance with Clause 9.2 above.

10. Procuring Entity's and Contractor's Risks

10.1 The Procuring Entity carries the risks which this Contract states are Procuring Entity's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Procuring Entity's Risks

11.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Procuring Entity's risks:

a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to

i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or

ii) negligence, breach of statutory duty, or interference with any legal right by the Procuring Entity or by any person employed by or contracted to him except the Contractor.

b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Procuring Entity or in the Procuring Entity's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

11.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is a Procuring Entity's risk except loss or damage due to

aa) a Defect which existed on the Completion Date,

bb) an event occurring before the Completion Date, which was not itself a Procuring Entity's risk, or

cc) the activities of the Contractor on the Site after the Completion Date.

12. Contractor's Risks

12.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Procuring Entity's risks are Contractor's risks.

13. Insurance

13.1 The Contractor shall provide, in the joint names of the Procuring Entity and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles **stated in the SCC** for the following events which are due to the Contractor's risks:

a) loss of or damage to the Works, Plant, and Materials;

b) loss of or damage to Equipment;

c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and

d) personal injury or death.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.3 If the Contractor does not provide any of the policies and certificates required, the Procuring Entity may effect the insurance which the Contractor should have provided and recover the premiums the Procuring Entity has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

13.4 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager.

13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Data

14.1 The Contractor shall be deemed to have examined any Site Data **referred to in the SCC**, supplemented by any information available to the Contractor.

15. Contractor to Construct the Works

15.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.

16. The Works to Be Completed by the Intended Completion Date

16.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

17. Approval by the Project Manager

17.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, for his approval.

17.2 The Contractor shall be responsible for design of Temporary Works.

17.3 The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

17.4 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

17.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

18. Safety

18.1 The Contractor shall be responsible for the safety of all activities on the Site.

19. Discoveries

19.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Procuring Entity. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

20. Possession of the Site

20.1 The Procuring Entity shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date **stated in the SCC,** the Procuring Entity shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.

21. Access to the Site

21.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

22. Instructions, Inspections and Audits

22.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.

22.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub-consultants to keep, accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.

22.3 The Contractor shall permit and shall cause its subcontractors and sub-consultants to permit, the Procuring Entity and/or persons appointed by the Public Procurement Regulatory Authority to inspect the Site and/or the accounts and records relating to the procurement process, selection and/or contract execution, and to have such accounts and records audited by auditors appointed by the Public Procurement Regulatory Authority. The Contractor's and its Subcontractors' and sub-consultants' attention is drawn to Sub-Clause 25.1 (Fraud and Corruption) which provides, inter alia, that acts intended to materially impede the exercise of the Public Procurement Regulatory Authority's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Public Procurement Regulatory Authority's prevailing sanctions procedures).

23. Appointment of the Adjudicator

23.1 The Adjudicator shall be appointed jointly by the Procuring Entity and the Contractor, at the time of the Procuring Entity's issuance of the Letter of Acceptance. If, in the Letter of Acceptance, the Procuring Entity does not agree on the appointment of the Adjudicator, the Procuring Entity will request the Appointing Authority designated in the SCC, to appoint the Adjudicator within 14 days of receipt of such request.

23.2 Should the Adjudicator resign or die, or should the Procuring Entity and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract, a new Adjudicator shall be jointly appointed by the Procuring Entity and the Contractor. In case of disagreement between the Procuring Entity and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority designated in the SCC at the request of either party, within 14 days of receipt of such request.

24. Settlement of Claims and Disputes

24.1 Contractor's Claims

24.1.1 If the Contractor considers itself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give Notice to the Project Manager, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 30 days after the Contractor became aware, or should have become aware, of the event or circumstance.

24.1.2 If the Contractor fails to give notice of a claim within such period of 30 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Procuring Entity shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub- Clause shall apply.

24.1.3 The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

24.1.4 The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Project Manager. Without admitting the Procuring Entity's liability, the Project Manager may, after receiving any notice under this Sub-Clause, monitor the record- keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all these records, and shall (if instructed) submit copies to the Project Manager.

24.1.5 Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

a) this fully detailed claim shall be considered as interim;
b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Project Manager may reasonably require; and
c) the Contractor shall send a final claim within 30 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Project Manager.

24.1.6 Within 42 days after receiving a Notice of a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Project Manager and approved by the Contractor, the Project Manager shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

24.1.7 Within the above defined period of 42 days, the Project Manager shall proceed in accordance with Sub-Clause

24.1.8 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the

additional payment (if any) to which the Contractor is entitled under the Contract.

24.1.9 Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

24.1.10 If the Project Manager does not respond within the timeframe defined in this Clause, either Party may consider that the claim is rejected by the Project Manager and any of the Parties may refer to Arbitration in accordance with Sub-Clause 24.4 [Arbitration].

24.1.11 The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause 24.3.

242 Amicable Settlement

24.1.1 Where a notice of a claim has been given, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, the Party giving a notice of a claim in accordance with Sub-Clause 24.1 above should move to commence arbitration after the fifty-sixth day from the day on which a notice of a claim was given, even if no attempt at an amicable settlement has been made.

243 Matters that may be referred to arbitration

24.3.1 Notwithstanding anything stated herein the following matters may be referred to arbitration before the practical completion of the Works or abandonment of the Works or termination of the Contract by either party:

a) The appointment of a replacement Project Manager upon the said person ceasing to act.
b) Whether or not the issue of an instruction by the Project Manager is empowered by these Conditions.
c) Whether or not a certificate has been improperly withheld or is not in accordance with these Conditions.
e) Any dispute arising in respect of war risks or war damage.
f) All other matters shall only be referred to arbitration after the completion or alleged completion of the Works or termination or alleged termination of the Contract, unless the Procuring Entity and the Contractor agree otherwise in writing.

244 Arbitration

24.4.1 Any claim or dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 24.3 shall be finally settled by arbitration.
24.4.2 No arbitration proceedings shall be commenced on any claim or dispute where notice of a claim or dispute has not been given by the applying party within ninety days of the occurrence or discovery of the matter or issue giving rise to the dispute.
24.4.3 Notwithstanding the issue of a notice as stated above, the arbitration of such a claim or dispute shall not commence unless an attempt has in the first instance been made by the parties to settle such claim or dispute amicably with or without the assistance of third parties. Proof of such attempt shall be required.
24.4.4 The Arbitrator shall, without prejudice to the generality of his powers, have powers to direct such measurements, computations, tests or valuations as may in his opinion be desirable in order to determine the rights of the parties and assess and award any sums which ought to have been the subject of or included in any certificate.
24.4.5 The Arbitrator shall, without prejudice to the generality of his powers, have powers to open up, review and revise any certificate, opinion, decision, requirement or notice and to determine all matters in dispute which shall be submitted to him in the same manner as if no such certificate, opinion, decision requirement or notice had been given.
24.4.6 The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Project Manager, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Project Manager from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.
24.4.7 Neither Party shall be limited in the proceedings before the arbitrators to the evidence, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction.
24.4.8 Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, and the Project Manager shall not be altered by reason of any arbitration being conducted during the progress of the Works.
24.4.9 The terms of the remuneration of each or all the members of Arbitration shall be mutually agreed upon by the

Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

24.5 Arbitration with National Contractors

24.5.1 If the Contract is with national contractors, arbitration proceedings will be conducted in accordance with the Arbitration Laws of Kenya. In case of any claim or dispute, such claim or dispute shall be notified in writing by either party to the other with a request to submit it to arbitration and to concur in the appointment of an Arbitrator within thirty days of the notice. The dispute shall be referred to the arbitration and final decision of a person to be agreed between the parties. Failing agreement to concur in the appointment of an Arbitrator, the Arbitrator shall be appointed, on the request of the applying party, by the Chairman or Vice Chairman of any of the following professional institutions;

i) Architectural Association of Kenya
ii) Institute of Quantity Surveyors of Kenya
iii) Association of Consulting Engineers of Kenya
iv) Chartered Institute of Arbitrators (Kenya Branch)
v) Institution of Engineers of Kenya

24.5.2 The institution written to first by the aggrieved party shall take precedence over all other institutions.

24.6 Alternative Arbitration Proceedings

24.6.1 Alternatively, the Parties may refer the matter to the Nairobi Centre for International Arbitration (NCIA) which offers a neutral venue for the conduct of national and international arbitration with commitment to providing institutional support to the arbitral process.

24.7 Failure to Comply with Arbitrator's Decision

24.7.1 The award of such Arbitrator shall be final and binding upon the parties.

24.7.2 In the event that a Party fails to comply with a final and binding Arbitrator's decision, then the other Party may, without prejudice to any other rights it may have, refer the matter to a competent court of law.

24.8 Contract operations to continue

24.8.1 Notwithstanding any reference to arbitration herein,

a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and
b) the Procuring Entity shall pay the Contractor any monies due the Contractor.

25. Fraud and Corruption

25.1 The Government requires compliance with the country's Anti-Corruption laws and its prevailing sanctions policies and procedures as set forth in the Constitution of Kenya and its Statutes.

25.2 The Procuring Entity requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.

B. Time Control

26. Program

26.1 Within the time stated in the SCC, after the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works. In the case of a lump sum contract, the activities in the Program shall be consistent with those in the Activity Schedule.

26.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

26.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period stated in the SCC. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the SCC from the next payment certificate and

continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall provide an updated Activity Schedule within 14 days of being instructed to by the Project Manager.

26.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

27. Extension of the Intended Completion Date

27.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.

27.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

28. Acceleration

28.1 When the Procuring Entity wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Procuring Entity accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Procuring Entity and the Contractor.

28.2 If the Contractor's priced proposals for an acceleration are accepted by the Procuring Entity, they are incorporated in the Contract Price and treated as a Variation.

29. Delays Ordered by the Project Manager

29.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

30. Management Meetings

30.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

30.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Procuring Entity. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

31. Early Warning

31.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

31.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.

C. Quality Control

32. Identifying Defects

32.1 The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

33. Tests

33.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

34. Correction of Defects

34.1 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the SCC. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

34.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

35. Uncorrected Defects

35.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

D. Cost Control

36. Contract Price[7]

36.1 The Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.

37. Changes in the Contract Price[8]

37.1 If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change. The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Procuring Entity.

37.2 If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.

38. Variations

38.1 All Variations shall be included in updated Programs[9] produced by the Contractor.

38.2 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

38.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.

38.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

---

[7] *In lump sum contracts, replace GCC Sub-Clauses 36.1 as follows:*

36.1 The Contractor shall provide updated Activity Schedules within 14 days of being instructed to by the Project Manager. The Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for materials on site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.

[8] *In lump sum contracts, replace entire GCC Clause 37 with new GCC Sub-Clause 37.1, as follows:*
The Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.

[9] *In lump sum contracts, add "and Activity Schedules" after "Programs."* [10] *In lump sum contracts, delete this paragraph.*

38.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning

38.6 If the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in Sub-Clause 39.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work

38.7 Value Engineering: The Contractor may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;

a) the proposed change(s), and a description of the difference to the existing contract requirements;
b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle costs) the Procuring Entity may incur in implementing the value engineering proposal; and
c) a description of any effect(s) of the change on performance/functionality.

38.8 The Procuring Entity may accept the value engineering proposal if the proposal demonstrates benefits that:

a) accelerate the contract completion period; or
b) reduce the Contract Price or the life cycle costs to the Procuring Entity; or
c) improve the quality, efficiency, safety or sustainability of the Facilities; or
d) yield any other benefits to the Procuring Entity, without compromising the functionality of the Works.

38.9 If the value engineering proposal is approved by the Procuring Entity and results in:

a) a reduction of the Contract Price; the amount to be paid to the Contractor shall be the **percentage specified in the SCC** of the reduction in the Contract Price; or
b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit described in (a) to (d) above, the amount to be paid to the Contractor shall be the full increase in the Contract Price.

39. Cash Flow Forecasts

39.1 When the Program[11], is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

40. Payment Certificates

40.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.

40.2 The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor.

40.3 The value of work executed shall be determined by the Project Manager.

40.4 The value of work executed shall comprise the value of the quantities of work in the Bill of Quantities that have been completed12.

40.5 The value of work executed shall include the valuation of Variations and Compensation Events.

40.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

40.7 Where the contract price is different from the corrected tender price, in order to ensure the contractor is not paid less or more relative to the contract price (which would be the tender price), payment valuation certificates and variation orders on omissions and additions valued based on rates in the Bill of Quantities or schedule of rates in the Tender, will be adjusted by a plus or minus percentage. The percentage already worked out during tender evaluation is worked out as follows: *(corrected tender price – tender price)/tender price X 100*.

41. Payments

41.1 Payments shall be adjusted for deductions for advance payments and retention. The Procuring Entity shall pay the Contractor the amounts certified by the Project Manager within 30 days of the date of each certificate. If the Procuring Entity makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.

41.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

41.3 Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.

41.4 Items of the Works for which no rate or price has been entered in shall not be paid for by the Procuring Entity and shall be deemed covered by other rates and prices in the Contract.

42. Compensation Events

42.1 The following shall be Compensation Events:

d) The Procuring Entity does not give access to a part of the Site by the Site Possession Date pursuant to GCC Sub-Clause 20.1.

e) The Procuring Entity modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.

f) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time.

g) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.

h) The Project Manager unreasonably does not approve a subcontract to be let.

i) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

j) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Procuring Entity, or additional work required for safety or other reasons.

k) Other contractors, public authorities, utilities, or the Procuring Entity does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

l) The advance payment is delayed.

m) The effects on the Contractor of any of the Procuring Entity's Risks.

n) The Project Manager unreasonably delays issuing a Certificate of Completion.

42.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

42.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.

---

[11] *In lump sum contracts, add "or Activity Schedule" after "Program."*

[12] *In lump sum contracts, replace this paragraph with the following: "The value of work executed shall comprise the value of completed activities in the Activity Schedule."*

42.4 The Contractor shall not be entitled to compensation to the extent that the Procuring Entity's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.

43. Tax

43.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 30 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC Clause 44.

44. Currency y of Payment

44.1 All payments under the contract shall be made in Kenya Shillings

45. Price Adjustment

45.1 Prices shall be adjusted for fluctuations in the cost of inputs only if **provided for in the SCC.** If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency. A separate formula of the type specified below applies:

P = A + B Im/Io

where:

P is the adjustment factor for the portion of the Contract Price payable.

A and B are coefficients[13] **specified in the SCC,** representing the non-adjustable and adjustable portions, respectively, of the Contract Price payable and Im is the index prevailing at the end of the month being invoiced and IOC is the index prevailing 30 days before Bid opening for inputs payable.

45.2 If the value of the index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next payment certificate. The index value shall be deemed to take account of all changes in cost due to fluctuations in costs.

46. Retention

46.1 The Procuring Entity shall retain from each payment due to the Contractor the proportion stated in the **SCC** until Completion of the whole of the Works.

46.2 Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC 53.1, half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected. The Contractor may substitute retention money with an "on demand" Bank guarantee.

47. Liquidated Damages

47.1 The Contractor shall pay liquidated damages to the Procuring Entity at the rate per day stated in the **SCC** for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the SCC. The Procuring Entity may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

47.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in GCC Sub-Clause 41.1.

48. Bonus

48.1 The Contractor shall be paid a Bonus calculated at the rate per calendar day **stated in the SCC** for each day (less any days for which the Contractor is paid for acceleration) that the Completion is earlier than the Intended Completion Date. The Project Manager shall certify that the Works are complete, although they may not be due to be complete.

49. Advance Payment

49.1 The Procuring Entity shall make advance payment to the Contractor of the amounts stated in the **SCC** by the date stated in the **SCC**, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Procuring Entity in amounts and currencies equal to the advance payment. The Guarantee shall remain effective until the advance payment has been repaid, but the amount of the Guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

49.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.

49.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.

50. Securities

50.1 The Performance Security shall be provided to the Procuring Entity no later than the date specified in the Letter of Acceptance and shall be issued in an amount **specified in the SCC,** by a bank or surety acceptable to the Procuring Entity, and denominated in the types and proportions of the currencies in which the Contract Price is payable. The Performance Security shall be valid until a date 28 day from the date of issue of the Certificate of Completion in the case of a Bank Guarantee, and until one year from the date of issue of the Completion Certificate in the case of a Performance Bond.

51. Dayworks

51.1 If applicable, the Dayworks rates in the Contractor's Bid shall be used only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

51.2 All work to be paid for as Dayworks shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done.

51.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

52. Cost of Repairs

52.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. Finishing the Contract

53. Completion

53.1 The Contractor shall request the Project Manager to issue a Certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the whole of the Works is completed.

54. Taking Over

54.1 The Procuring Entity shall take over the Site and the Works within seven days of the Project Manager's issuing a certificate of Completion.

55. Final Account

55.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

---

[13] *The sum of the two coefficients A and B should be 1 (one) in the formula for each currency. Normally, both coefficients shall be the same in the formulae for all currencies, since coefficient A, for the non-adjustable portion of the payments, is a very approximate figure (usually 0.15) to take account of fixed cost elements or other non-adjustable components. The sum of the adjustments for each currency are added to the Contract Price.*

56. Operating and Maintenance Manuals

56.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the SCC.

56.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the SCC pursuant to GCC Sub-Clause 56.1, or they do not receive the Project Manager's approval, the Project Manager shall withhold the amount **stated in the SCC** from payments due to the Contractor.

57. Termination

57.1 The Procuring Entity or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

57.2 Fundamental breaches of Contract shall include, but shall not be limited to, the following:

a) the Contractor stops work for 30 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager;

b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days;

c) the Procuring Entity or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

d) a payment certified by the Project Manager is not paid by the Procuring Entity to the Contractor within 84 days of the date of the Project Manager's certificate;

e) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;

f) the Contractor does not maintain a Security, which is required;

g) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as **defined in the SCC**; or

h) if the Contractor, in the judgment of the Procuring Entity has engaged in Fraud and Corruption, as defined in paragraph 2.2 a of the Appendix A to the GCC, in competing for or in executing the Contract, then the Procuring Entity may, after giving fourteen (14) days written notice to the Contractor, terminate the Contract and expel him from the Site.

57.3 Notwithstanding the above, the Procuring Entity may terminate the Contract for convenience.

57.4 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

57.5 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC Sub-Clause 56.2 above, the Project Manager shall decide whether the breach is fundamental or not.

58. Payment upon Termination

58.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as specified in the SCC. Additional Liquidated Damages shall not apply. If the total amount due to the Procuring Entity exceeds any payment due to the Contractor, the difference shall be a debt payable to the Procuring Entity.

58.2 If the Contract is terminated for the Procuring Entity's convenience or because of a fundamental breach of Contract by the Procuring Entity, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

59. Property

59.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Procuring Entity if the Contract is terminated because of the Contractor's default.

60. Release from Performance

60.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Procuring Entity or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment wasmade.

SECTION IX - SPECIAL CONDITIONS OF CONTRACT

Number of GC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
	A. General
GCC 1.1 (q)	The Procuring Entity is **NORTHERN WATER WORKS DEVELOPMENT AGENCY** **Maji House, Kismayu Road** **PO Box 495 – 70100 Garissa, Kenya** **Tel: +254-46-2103598/3797** **E-mail: info@nwwda.go.ke**
GCC 1.1 (u)	The Intended Completion Date for the whole of the Works shall be **After 9 calendar Months**
GCC 1.1 (x)	The Project Manager is *The* **Technical Services Manager NWWDA**
GCC 1.1 (z)	The Site is located at Lesoit area of **Baragoi, Samburu North sub County of Samburu County**
GCC 1.1 (cc)	The Start Date shall be **after signing of the Contract and issuance of letter to commence works**
GCC 1.1 (gg)	The Works consist of **a. Excavation of 80,000m^3 of Soil in the Reservoir area** **b. Compacting of 35,000m^3 of Earth Embankment** **c. Construction of spillway and the Water Inlet channels** **d. Carting away the Excavated material to spoil to Embankment and or spoil** **e. Lining of the Dam with Rip rap as appropriate** **f. Construction of a 75mm dia 2.4km long of HDPE PN 10 Rising main** **g. Fabrication and erection of a 1om high hoist steel girder** **h. Installation of a 10m^3 Plastic Tank on a steel Girder** **i. Purchase and installation of Solar, a pump and other related electro mechanical equipment including wiring** **j. Rehabilitation of two existing Water Kiosks** **k. Fencing with concrete posts and chain-link of approximately 1,500m long**
GCC 2.2	Sectional Completions are: ***N/A***
GCC 5.1	The Project manager *may* delegate any of his duties and responsibilities.
GCC 8.1	Schedule of other contractors: ***N/A***
GCC 9.1	**Key Personnel** GCC 9.1 is replaced with the following: 9.1 Key Personnel are the Contractor's personnel named in this GCC 9.1 of the Special Conditions of Contract. The Contractor shall employ the Key Personnel and use the equipment identified in its Bid, to carry out the Works or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of Key Personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.

No.	Position	Minimum Qualifications	Experience in Similar Works (years)

Number of GC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract

1.	Contractor's Representative / Site Agent- One (1 Nr)	•Degree in Civil or Water Engineering or equivalent or •Higher Diploma in Civil or Water Engineering or equivalent or	5
2.	Surveyor- One (1 Nr)	• Degree/Diploma in Survey or equivalent	5
3.	General Foreman (1No)	•Diploma in Civil or Water Engineering	5
4.	Clerk of Works (1 No)	•Diploma in Civil or Water Engineering or •Construction Technician Course a	5
5.	Power Plant Mechanic (1)	•Diploma in Mechanical Engineering (Plant Option)	5
6.	Artisan/Plumber - Two (2 Nr)	•Certificate in plumbing	5
7.	Carpenter	•Certificate in Carpentry & Joinery	5

GCC 13.1	The minimum insurance amounts and deductibles shall be: (a) For loss or damage to the Works, Plant and Materials: **Equivalent to contract price;** (b) For loss or damage to Equipment: **KES 10 Million** (c) For loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract **KES 10 Million** (d) For personal injury or death: (i) of the Contractor's employees: **KES 5 Million** (ii) of other people: Kshs5 million: **KES 5 Million**
GCC 14.1	Site Data are: **The bidder shall rely on the provided contract drawings, data and physical site inspections and investigations by the bidder.**
GCC 20.1	The Site Possession Date(s) shall be: **Within 14 days of the Commencement Date**
GCC 23.1 & GCC 23.2	Appointing Authority for the Adjudicator **The Kenya Chapter of the Chartered Institute of Arbitrators, P.O Box 50163-00200, Nairobi.**
	Hourly rate and types of reimbursable expenses to be paid to the Adjudicator: ***Kshs. 25,000/-***
B. Time Control	
GCC 26.1	The Contractor shall submit for approval a Program for the Works within *14* days from the date of the Letter of Acceptance.
GCC 26.3	The period between Program updates is ***Quarterly*** The amount to be withheld for late submission of an updated Program is ***KES 100,000*** The period for submission of progress reports is ***Monthly***
C. Quality Control	
GCC 34.1	The Defects Liability Period is: ***6 Months (180 Days)*.**
D. Cost Control	
GCC 38.9	If the value engineering proposal is approved by the Procuring Entity the amount to be paid to

Number of GC Clause	Amendments of, and Supplements to, Clauses in the General Conditions of Contract
	the Contractor shall be **N/A**
GCC 44.1	The currency of the Procuring Entity's Kenya **Shillings**
GCC 45.1	The Contract **IS NOT** subject to price adjustment in accordance with GCC Clause 45, and the following information regarding coefficients ***does not*** apply.
GCC 46.1	The proportion of payments retained is: ***10%*** Limit of Retention: **5% of Accepted Contract Amount (inclusive of VAT)**
GCC 47.1	The liquidated damages for the whole of the Works are five **(0.05%) of *final Contract Price* per day. *The maximum amount of liquidated damages for the whole of the Works is 5% of the final Contract Price***
GCC 49.1	The Advance Payments shall be: **20% *of Accepted Contract Amount (inclusive of VAT)***
GCC 50.1	The Performance Security amount is: (a) Performance Security – Bank Guarantee (unconditional and on demand): in the amount(s) of **ten (10) percent** of the Accepted Contract Amount and in the same currency (ies) of the Accepted Contract Amount. (b) Performance Security – Performance Bond: **N/A** .
E. Finishing the Contract	
GCC 56.1	The date by which operating and maintenance manuals are required is **30 days after substantial completion certificate.** The date by which "as built" drawings are required is **30 days after substantial completion.**
GCC 56.2	The amount to be withheld for failing to produce "as built" drawings and/or operating and maintenance manuals by the date required in GCC Sub-Clause 58.1 is **KES 250, 000/-**
GCC 57.2 (g)	The maximum number of days is: ***90 Days***
GCC 58.1	The percentage to apply to the value of the work not completed, representing the Employer's additional cost for completing the Works, is ***15% (Fifteen Percent)***

FORM No 1: NOTIFICATION OF INTENTION TO AWARD

This Notification of Intention to Award shall be sent to each Tenderer that submitted a Tender. Send this Notification to the Tenderer's Authorized Representative named in the Tender Information Form on the format below.

FORMAT

1. For the attention of Tenderer's Authorized Representative
   - *i)* Name: *[insert Authorized Representative's name]*
   - *ii)* Address: *[insert Authorized Representative's Address]*
   - *iii)* Telephone: *[insert Authorized Representative's telephone/fax numbers]*
   - *iv)* Email Address: *[insert Authorized Representative's email address]*

   [IMPORTANT: insert the date that this Notification is transmitted to Tenderers. The Notification must be sent to all Tenderers simultaneously. This means on the same date and as close to the same time as possible.]

2. Date of transmission: [*email*] on [*date*] (local time)

   This Notification is sent by (*Name and designation*) _____

3. Notification of Intention to Award

   - *i)* Procuring Entity **Northern Water Works Development Agency**
   - ***ii)*** Project**: Lesoit Dam Water Project**
   - ***iii)*** Contract title: **Construction of Lesoit Dam Water Project**
   - *iv)* Country: **Kenya**
   - **v)** ITT No: **NWWDA/T/CW/015/2022-2023**
   - vi) This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

4. Request a debriefing in relation to the evaluation of your tender

   Submit a Procurement-related Complaint in relation to the decision to award the contract.

   a) The successful tenderer

      i) Name of successful Tender_____

      ii) Address of the successful Tender _____

      iii) Contract price of the successful Tender Kenya Shillings _____ (in words_____)

   b) Other Tenderers

   Names of all Tenderers that submitted a Tender. If the Tender's price was evaluated include the evaluated price as well as the Tender price as read out. For Tenders not evaluated, give one main reason the Tender was unsuccessful.

SNo	Name of Tender	Tender Price as read out	Tender's evaluated price (Note a)	One Reason Why not Evaluated
1				
2				
3				

(Note a) State NE if not evaluated

5. How to request a debriefing

a) DEADLINE: The deadline to request a debriefing expires at midnight on [*insert date*] (*local time*).

b) You may request a debriefing in relation to the results of the evaluation of your Tender. If you decide to request a debriefing your written request must be made within three (5) Business Days of receipt of this Notification of Intention to Award.

c) Provide the contract name, reference number, name of the Tenderer, contact details; and address the request for debriefing as follows:

i) Attention: [*insert full name of person, if applicable*]

ii) Title/position: [*insert title/position*]

ii) Agency: [*insert name of Procuring Entity*]

iii) Email address: [*insert email address*]

d) If your request for a debriefing is received within the 3 Days deadline, we will provide the debriefing within five (3) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (3) Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

e) The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

f) If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Days from the date of publication of the Contract Award Notice.

6. How to make a complaint

a) Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, [*insert date*] (local time).

b) Provide the contract name, reference number, name of the Tenderer, contact details; and address the Procurement-related Complaint as follows:

i) Attention: [*insert full name of person, if applicable*]

ii) Title/position: [*insert title/position*]

iii) Agency: [*insert name of Procuring Entity*]

iv) Email address: [*insert email address*]

c) At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

d) Further information: For more information refer to the Public Procurement and Disposals Act 2015 and its Regulations available from the Website info@ppra.go.ke or complaints@ppra.go.ke.

You should read these documents before preparing and submitting your complaint.

e) There are four essential requirements:

i) You must be an 'interested party'. In this case, that means a Tenderer who submitted a Tender in this tendering process, and is the recipient of a Notification of Intention to Award.

ii) The complaint can only challenge the decision to award the contract.

iii) You must submit the complaint within the period stated above.

iv) You must include, in your complaint, all of the information required to support your complaint.

7. Standstill Period

i) DEADLINE: The Standstill Period is due to end at midnight on [*insert date*] (local time).

ii) The Standstill Period lasts ten (14) Days after the date of transmission of this Notification of Intention to Award.

iii) The Standstill Period may be extended as stated in paragraph Section 5 (d) above.

If you have any questions regarding this Notification please do not hesitate to contact us. On behalf of the

Procuring Entity:

Signature:_____ **Name:**_____

Title/position:_____ **Telephone:**___ **Email:** _____

FORM NO. 2 - REQUEST FOR REVIEW

FORM FOR REVIEW (r.203(1))

PUBLIC PROCUREMENT ADMINISTRATIVE REVIEW BOARD

APPLICATION NO…….OF……..…20……...

BETWEEN

……...…….APPLICANT

AND

……RESPONDENT (Procuring Entity)

Request for review of the decision of the…… (Name of the Procuring Entity of ……dated the…day of ……20…….in the matter of Tender No……..…of ……..20….. for .....(Tender description).

REQUEST FOR REVIEW

I/We……,the above named Applicant(s), of address: Physical address…….P. O. Box No……. Tel. No……..Email ……, hereby request the Public Procurement Administrative Review Board to review the whole/part of the above mentioned decision on the following grounds , namely:

1.

2.

By this memorandum, the Applicant requests the Board for an order/orders that:

1.

2.

SIGNED …….(Applicant) Dated on…….day of ……/…20……

FOR OFFICIAL USE ONLY Lodged with the Secretary Public Procurement Administrative Review Board on……day of ……....20….……

SIGNED

Board Secretary

FORM NO 3: LETTER OF AWARD

[letterhead paper of the Procuring Entity] [date]

To: *[name and address of the Contractor]*

This is to notify you that your Tender dated *[date]* for execution of the *[name of the Contract and identification number, as given in the Contract Data]* for the Accepted Contract Amount *[amount in numbers and words] [name of currency]*, as corrected and modified in accordance with the Instructions to Tenderers, is hereby accepted by ……. (*name of Procuring Entity)*.

You are requested to furnish the Performance Security within 30 days in accordance with the Conditions of Contract, using, for that purpose, one of the Performance Security Forms included in Section VIII, Contract Forms, of the Tender Document.

Authorized Signature:.....

Name and Title of Signatory:.....

Name of Procuring Entity.....

Attachment: *Contract Agreement*.....

FORM NO 4: CONTRACT AGREEMENT

THIS AGREEMENT made the_____day of_____, **2022**_____, between **Northern Water Works Development Agency** hereinafter "the Procuring of the one part, and_____of_ _____(hereinafter "the Contractor"), of the other part:

WHEREAS the Procuring Entity desires that the Works known as _____sh ould be executed by the Contractor, and has accepted a Tender by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Procuring Entity and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
   a) the Letter of Acceptance
   b) the Letter of Tender
   c) the addenda Nos_____(if any)
   d) the Special Conditions of Contract
   e) the General Conditions of Contract;
   f) the Specifications
   g) the Drawings; and
   h) the completed Schedules and any other documents forming part of the contract.

3. In consideration of the payments to be made by the Procuring Entity to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Procuring Entity to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Procuring Entity hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the Laws of Kenya on the day, month and year specified above.

Signed and sealed by_____(for the Procuring Entity)

Signed and sealed by_____(for the Contractor).

FORM NO. 5 - PERFORMANCE SECURITY

[Option 1 - Unconditional Demand Bank Guarantee]

[Guarantor letterhead]

Beneficiary:_____*[insert name and Address of* Procuring Entity*]* **Date:**_____

_____*[Insert date of issue]*

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that_____(hereinafter called "the Contractor") has entered into Contract No._____dated_____with (*name of Procuring Entity*)_____(the Procuring Entity as the Beneficiary), for the execution of _____(hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

3. At the request of the Contractor, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of_____(*in words*),[1] such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

4. This guarantee shall expire, no later than the …. Day of ……, 2...…[2], and any demand for payment under it must be received by us at the office indicated above on or before that date.

5. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year]*, in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

[Name of Authorized Official, signature(s) and seals/stamps].

Note: *All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.*

[1] *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency of the Contract or a freely convertible currency acceptable to the Beneficiary.*

[2] *Insert the date twenty-eight days after the expected completion date as described in GC Clause 11.9. The Procuring Entity should note that in the event of an extension of this date for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

FORM No. 6 - PERFORMANCE SECURITY

[Option 2– Performance Bond]

[Note: Procuring Entities are advised to use Performance Security – Unconditional Demand Bank Guarantee instead of Performance Bond due to difficulties involved in calling Bond holder to action]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: Northern Water Works Development Agency*]* Date:__*[Insert date of issue]*.

PERFORMANCE BONDNo.:_____

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

1. By this Bond_____as Principal (hereinafter called "the Contractor") and_____] as Surety (hereinafter called "the Surety"), are held and firmly bound unto **Northern Water Works Development Agency** as Obligee (hereinafter called "the Procuring Entity") in the amount of_____for the payment of which sum well and truly to be made in the types and proportions of currencies in which the Contract Price is payable, the Contractor and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

2. WHEREAS the Contractor has entered into a written Agreement with the Procuring Entity dated the _____day of_____, 20 , for_____in accordance with the documents, plans, specifications, and amendments thereto, which to the extent herein provided for, are by reference made part hereof and are hereinafter referred to as the Contract.

3. NOW, THEREFORE, the Condition of this Obligation is such that, if the Contractor shall promptly and faithfully perform the said Contract (including any amendments thereto), then this obligation shall be null and void; otherwise, it shall remain in full force and effect. Whenever the Contractor shall be, and declared by the Procuring Entity to be, in default under the Contract, the Procuring Entity having performed the Procuring Entity's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:
   1) complete the Contract in accordance with its terms and conditions; or
   2) obtain a tender or tenders from qualified tenderers for submission to the Procuring Entity for completing the Contract in accordance with its terms and conditions, and upon determination by the Procuring Entity and the Surety of the lowest responsive Tenderers, arrange for a Contract between such Tenderer, and Procuring Entity and make available as work progresses (even though there should be a default or a succession of defaults under the Contract or Contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the Balance of the Contract Price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "Balance of the Contract Price," as used in this paragraph, shall mean the total amount payable by Procuring Entity to Contractor under the Contract, less the amount properly paid by Procuring Entity to Contractor; or
   3) pay the Procuring Entity the amount required by Procuring Entity to complete the Contract in accordance with its terms and conditions up to a total not exceeding the amount of this Bond.

4. The Surety shall not be liable for a greater sum than the specified penalty of this Bond.

5. Any suit under this Bond must be instituted before the expiration of one year from the date of the issuing of the Taking-Over Certificate. No right of action shall accrue on this Bond to or for the use of any person or corporation other than the Procuring Entity named herein or the heirs, executors, administrators, successors, and assigns of the Procuring Entity.

6. In testimony whereof, the Contractor has hereunto set his hand and affixed his seal, and the Surety has caused these presents to be sealed with his corporate seal duly attested by the signature of his legal representative, this day_____of_____20_____.

SIGNED ON_____on behalfof By___in the capacity of In the presence of

SIGNED ON_____on behalf of By__in the capacity of In the presence of

FORM NO. 7 - ADVANCE PAYMENT SECURITY

[Demand Bank Guarantee]

[Guarantor letterhead]

Beneficiary: _____ *[Insert name and Address of* Procuring Entity*]*
Date: _____ *[Insert date of issue]*

ADVANCE PAYMENT GUARANTEE No.: _____ *[Insert guarantee reference number]* **Guarantor:** _____

_____ **[***Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that _____ (hereinafter called "the Contractor") has entered into Contract No. _____ *dated* _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum _____ (*in words*) is to be made against an advance payment guarantee.

3. At the request of the Contractor, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (*in words* _____)[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the Applicant:
   a) has used the advance payment for purposes other than the costs of mobilization in respect of the Works; or
   b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Contractor on its account number _____ at _____.

5. The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as specified in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety (90) percent of the Accepted Contract Amount, less provisional sums, has been certified for payment, or on the _____ day of _____, 2 ,[2] whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months][one year],* in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

[Name of Authorized Official, signature(s) and seals/stamps]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[1] *The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency of the advance payment as specified in the Contract.*

[2] *Insert the expected expiration date of the Time for Completion. The Procuring Entity should note that in the event of an extension of the time for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

FORM NO. 8 - RETENTION MONEY SECURITY

[Demand Bank Guarantee]

[Guarantor letterhead]

Beneficiary: _____*[Insert name and Address of* Procuring Entity*]*

Date:_____*[Insert date of issue]*

Advance payment guarantee no. *[Insert guarantee reference number]*

Guarantor: [*Insert name and address of place of issue, unless indicated in the letterhead]*

1. We have been informed that_____*[insert name of Contractor, which in the case of a joint venture shall be the name of the joint venture]* (hereinafter called "the Contractor") has entered into Contract No. _____*[insert reference number of the contract]* dated_____with the Beneficiary, for the execution of_____*[insert name of contract and brief description of* Works*]* (hereinafter called "the Contract").

2. Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains moneys up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, and payment of *[*insert the second half of the Retention Money] is to be made against a Retention Money guarantee.

3. At the request of the Contractor, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[insert amount in figures]* (*[insert amount in words_____])*[1] upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or show grounds for your demand or the sum specified therein.

4. A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the second half of the Retention Money as referred to above has been credited to the Contractor on its account number___at_ *[insert name and address of Applicant's bank]*.

5. This guarantee shall expire no later than the …..... Day of ….....……, 2.....…[2], and any demand for payment under it must be received by us at the office indicated above on or before that date.

6. The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[six months] [one year],* in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee.

[Name of Authorized Official, signature(s) and seals/stamps]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

[1] *The Guarantor shall insert an amount representing the amount of the second half of the Retention Money.*

[2]*Insert a date that is twenty-eight days after the expiry of retention period after the actual completion date of the contract. The Procuring Entity should note that in the event of an extension of this date for completion of the Contract, the Procuring Entity would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee.*

FORM NO. 9 BENEFICIAL OWNERSHIP DISCLOSURE FORM

INSTRUCTIONS TO TENDERERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form ("Form") is to be completed by the successful tenderer. In case of joint venture, the tenderer must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Tenderer is any natural person who ultimately owns or controls the Tenderer by meeting one or more of the following conditions:

- *Directly or indirectly holding 25% or more of the shares.*
- *Directly or in directly holding 25% or more of the voting rights.*
- *Directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer.*

Tender Reference No.:_____[*insert identification no*] Name of the Assignment:_____*[insert name of the assignment]* to:_____*[insert complete name of Procuring Entity]*

In response to your notification of award dated_____*[insert date of notification of award]* to furnish additional information on beneficial ownership:_____*[select one option as applicable and delete the options that are not applicable]*

I) We here by provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	**Directly or indirectly holding 25% or more of the shares (Yes / No)**	**Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)**	**Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Tenderer (Yes / No)**
[include full name (last, middle, first), nationality, country of residence]			

OR

ii) We declare that there is no Beneficial Owner meeting one or more of the following conditions: directly or indirectly holding 25% or more of the shares. Directly or indirectly holding 25% or more of the voting rights. Directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer.

OR

We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. [If this option is selected, the Tenderer shall provide explanation on why it is unable to identify any Beneficial Owner]

Directly or indirectly holding 25% or more of the shares. Directly or indirectly holding25% or more of

the voting rights.

Directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Tenderer]"

Name of the Tenderer: .....[insert complete name of the Tenderer]*_____

*Name of the person duly authorized to sign the Tender on behalf of the Tenderer: ** [insert complete name of person duly authorized to sign the Tender]*

Title of the person signing the Tender: ..... [insert complete title of the person signing the Tender]

Signature of the person named above: ..... [insert signature of person whose name and capacity are shown above]

Date signed ..... [insert date of signing] day of..... [Insert month], [insert year]

NORTHERN WATER WORKS DEVELOPMENT AGENCY

TENDER DOCUMENT FOR CONSTRUCTION OF LESOIT WATER DAM PROJECT: ~ TENDER NO. NWWDA/CW/T/0015/2022~2023

VOLUME II

TECHNICAL DRAWINGS

PROCURING ENTITY

NORTHERN WATER WORKS DEVELOPMENT AGENCY

Maji House, Kismayu Road

PO Box 495 – 70100 Garissa, Kenya

Tel: +254~46~2103598/3797

E~mail: info@nwwda.go.ke

LIST OF DRAWINGS

LOCATION MAPS

	DRAWING NO.	DRAWING NAME	NO. OF SHEETS
1.	LESOIT/DAM/01	GENERAL LOCATION MAP	1
2.	LESOIT/DAM/02	LOCATION MAP	1

DAM

3.	LESOIT/DAM/01	DAM GENERAL LAYOUT PLAN	1
4.	LESOIT/DAM/02	DAM AND RESERVOIR LAYOUT PLAN	1
5.	LESOIT/DAM/03	DAM LAYOUT PLAN (SURVEY SET-OUT DATA)	1
6.	LESOIT/DAM/04	DAM LAYOUT PLAN (EXISTING GROUND LEVEL)	1
7.	LESOIT/DAM/05	DAM LONGITUDINAL SECTION	1
8.	LESOIT/DAM/06	TYPICAL EMBANKMENT SECTION	1
9.	LESOIT/DAM/07	EMBANKMENT SECTION DETAILS	1

SPILLWAY

10.	LESOIT/SPI/01	SPILLWAY PLAN AND PROFILE	1
11.	LESOIT/SPI/02	SPILLWAY CROSS SECTIONS	4

No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

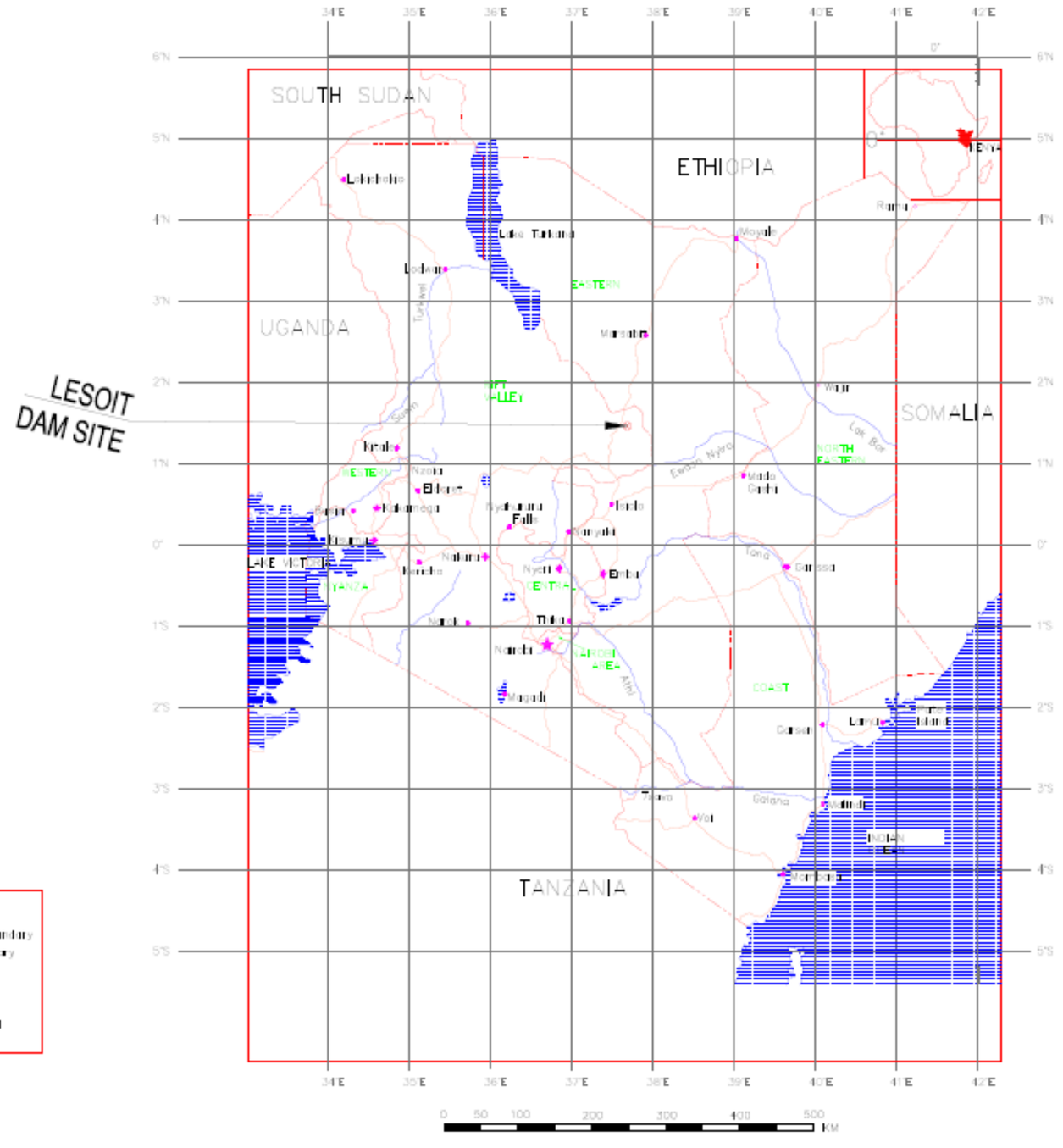
Client:

PROJECT NAME: LESOIT DAM

TITLE OF DRAWING: LIST OF DRAWINGS

Designed:
Drawn:
Checked:
Approved:

Date:
Scale: 1:1000
DRG. No.:
Sheet No.: 3\3



NORTH

LEGEND

- International Boundary
- Provincial Boundary
- Road
- River
- National Capital
- Provincial Capital
- City or Town

LOCATION MAP

No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

Client

PROJECT NAME: LESOIT DAM

TITLE OF DRAWING: PROJECT LOCATION MAP

Designed:	Date:
Drawn:	Scale: 1:5000
Checked:	DRG. No.:
Approved:	Sheet No.: 4/4

TOP WATER LEVEL CONTOUR(1336.00m)

CREST LEVEL(1337.00m)

EMBANKMENT

SPILLWAY

CONCRETE SILLS

A

Meters

37.5 0 37.5 75

1:1250

No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

Client

PROJECT NAME:

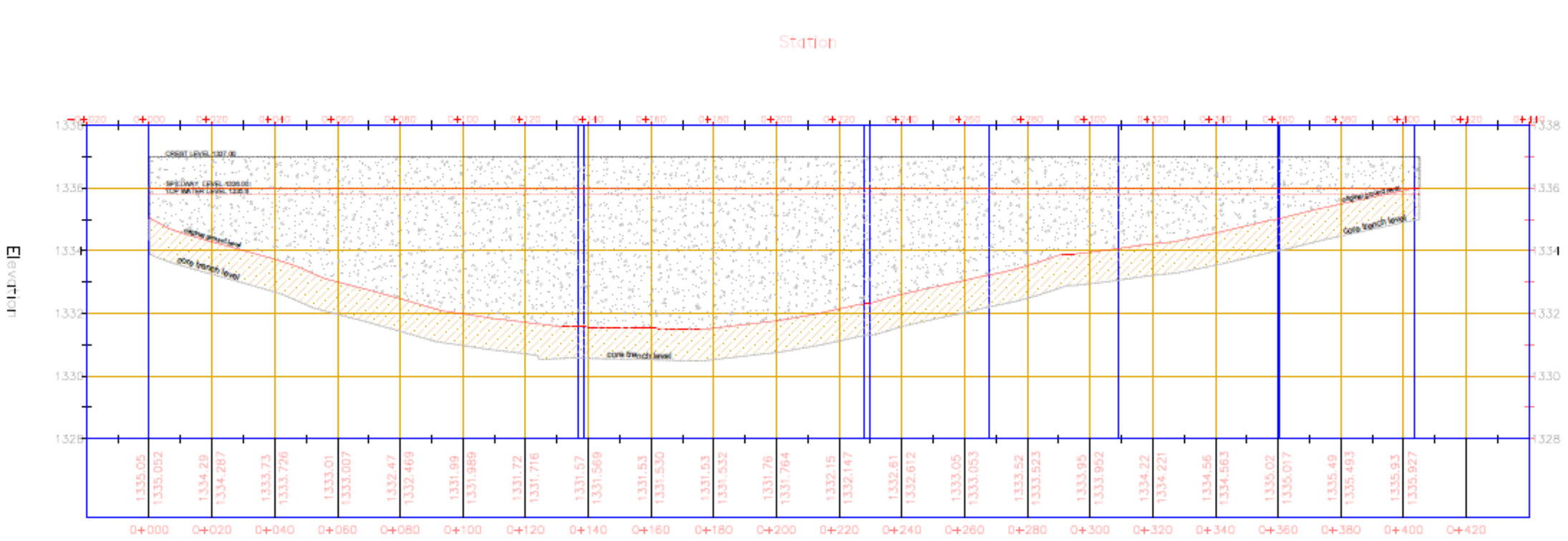
LESOIT DAM

TITLE OF DRAWING:

DAM GENERAL LAYOUT

Designed:	Date:
Drawn:	Scale: 1:1000
Checked:	DRG. No.:
Approved:	Sheet No.: 3/3

EMBANKMENT ALIGNMENT PROFILE



SECTION A - A
ALONG CENTRE LINE (SEE DRAWING LAYOUT)
SCALE 1:1000

No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

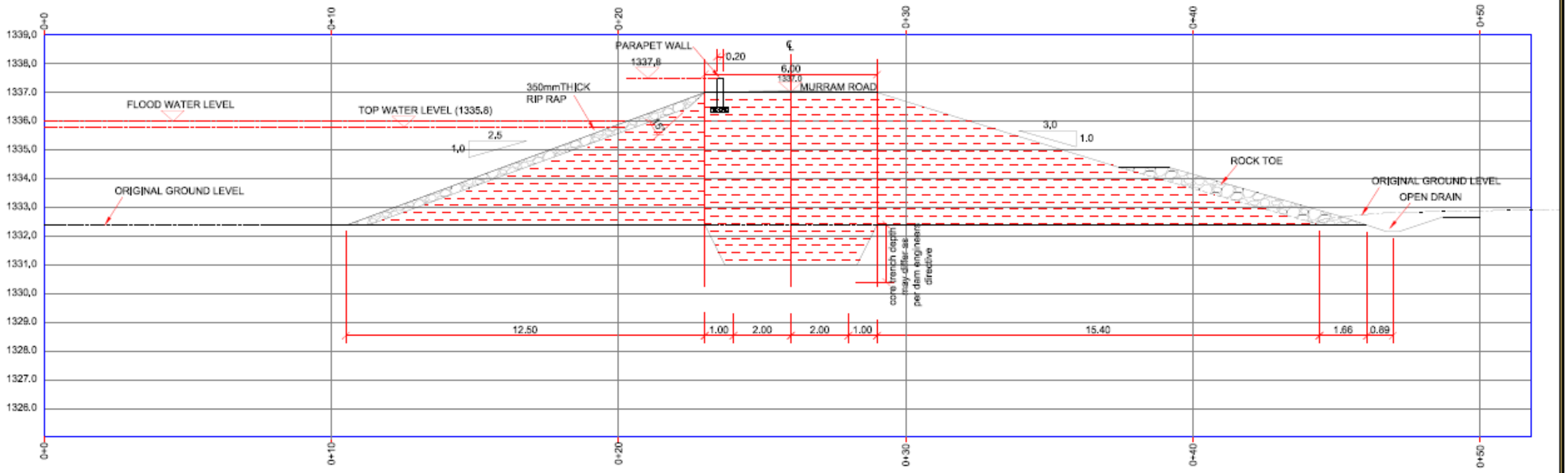
Client

PROJECT NAME:
LESOIT DAM

TITLE OF DRAWING:
DAM LONGITUDINAL SECTION

Designed:	Date:
Drawn:	Scale: 1:1000
Checked:	DRG. No.:
Approved:	Sheet No.: 2/2

TYPICAL EMBANKMENT SECTION



No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

Client

PROJECT NAME

LESOIT DAM

TITLE OF DRAWING:

TYPICAL EMBANKMENT SECTION

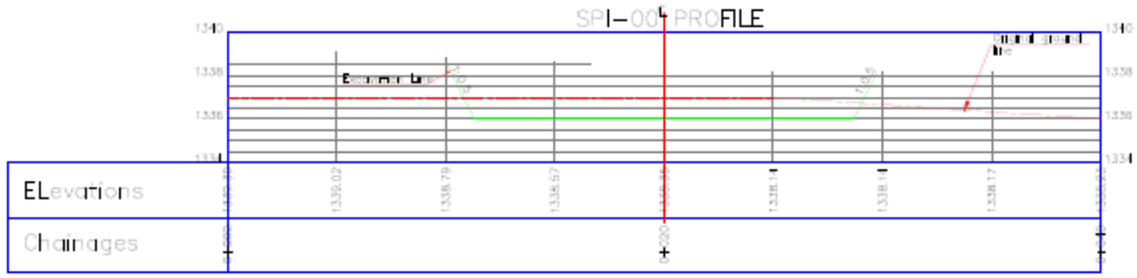
Designed | Date:

Drawn | Scale: 1:500

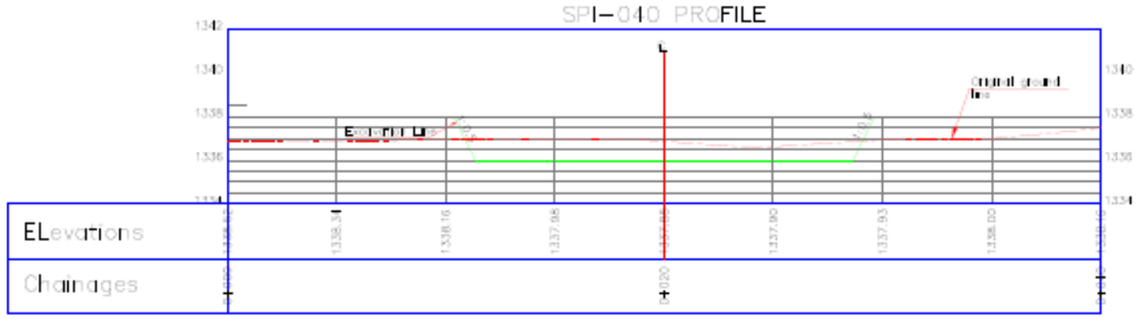
Checked | DRG. No.:

Approved | Sheet No.: 1/1

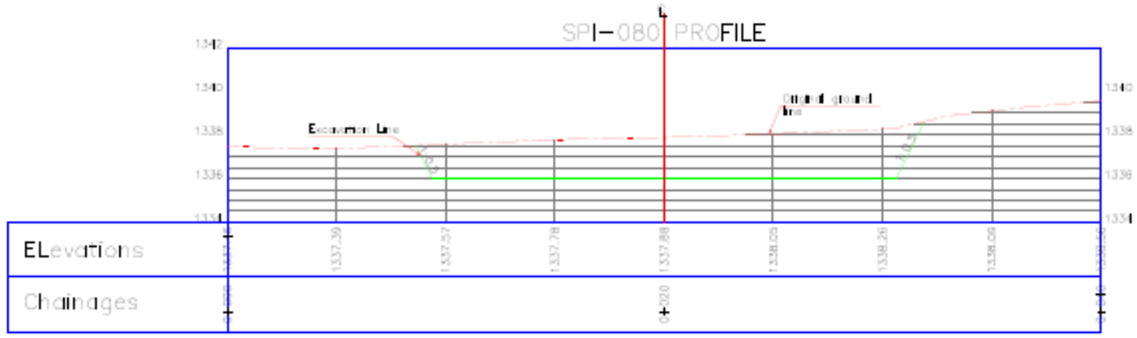
SPI-000 PROFILE



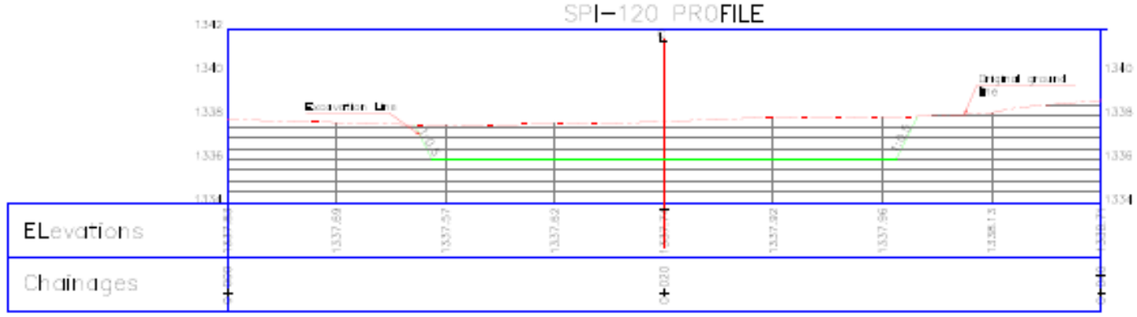
SPI-040 PROFILE



SPI-080 PROFILE



SPI-120 PROFILE



No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

Client

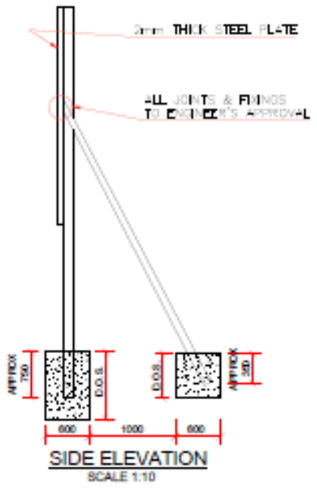
PROJECT NAME:

LESOIT DAM

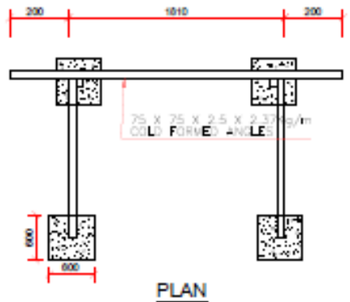
TITLE OF DRAWING:

SPILLWAY CROSS-SECTION

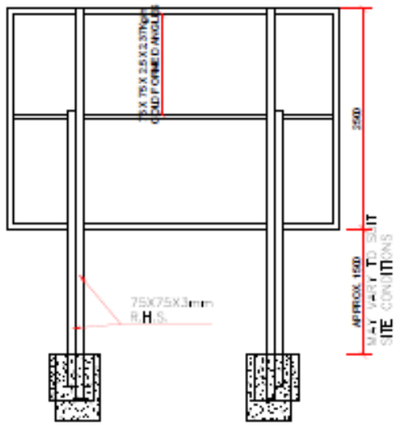
Designed:	Date:
Drawn:	Scale: 1:500
Checked:	DRG. No.:
Approved:	Sheet No.: 6/6



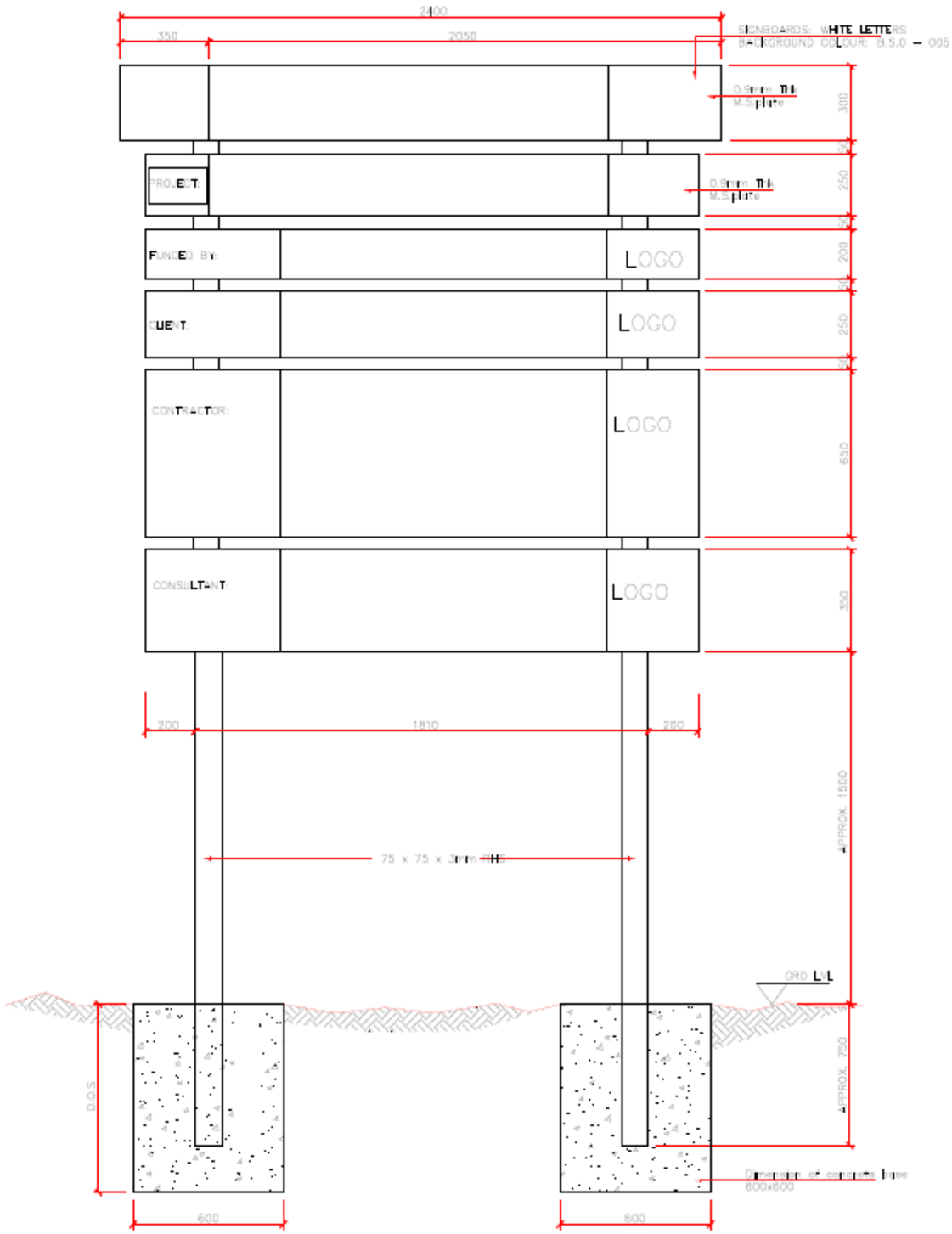
SIDE ELEVATION
SCALE 1:10



PLAN
SCALE 1:10



REAR ELEVATION
SCALE 1:10



PUBLICITY SIGN BOARD
SCALE 1:10

No.	REVISION	APPROVAL	DATE	REFERENCE	DWG No.

Client

PROJECT NAME:
LESOIT DAM

TITLE OF DRAWING:
PROJECT SIGNBOARD

Designed:	Date:
Drawn:	Scale: 1:5000
Checked:	DRG. No.:
Approved:	Sheet No.: 5/5

REPUBLIC OF KENYA

MINISTRY OF WATER & SANITATION AND IRRIGATION

NORTHERN WATER WORKS DEVELOPMENT AGENCY

TENDER DOCUMENT FOR CONSTRUCTION OF LESOIT WATER DAM PROJECT: -

TENDER NO. NWWDA/CW/T/0015/2022-2023

VOLUME III

SPECIFICATIONS

PROCURING ENTITY

NORTHERN WATER WORKS DEVELOPMENT AGENCY
Maji House, Kismayu Road
PO Box 495 – 70100 Garissa, Kenya
Tel: +254-46-2103598/3797
E-mail: info@nwwda.go.ke

Table of Contents

1. GENERAL (PRELIMINARIES)

1.1 Introduction

These specifications cover the construction of **LESOIT DAM WATER PROJECT** as shown on the drawings and listed in the Bills of Quantities and shall be read in conjunction with the Contract Documents as listed in Instruction to Bidders.

All references given are intended solely for the convenience of those using the above documents and shall in no way exclude the application of the other clauses in the documents which may, in the opinion of the Engineer have any bearing on the point in question.

1.1.1 Location and Extent of Site

The project area is in Samburu North Sub-County, Samburu County in Kenya. It is located in Ngilai area with Baragoi Town being the nearest market center. Baragoi is also the headquarters of the Samburu North Sub County.

The site of works shall be the area within the various pipeline routes, quarries, borrow pits, spoil areas, access roads and deviations, Contractor's installations, Storage areas, Camp site, Engineer's offices, laboratories and accommodation, shown on the drawings or established specifically for the Contract with the approval of the Engineer.

1.2 Extent of Contract

The works specified under this contract shall include all general works, preparatory to the construction of the works and materials and work of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the extent as shown on the drawings and these specifications and any other instructions that may be issued by the Engineer from time to time whether specifically mentioned or not in the clauses of this specification.

1.2.1 Contract Drawings

Two sets of full-sized drawings will be issued to the Contractor, at the commencement of the Contract to facilitate the construction of the Works in complete conformity with and to the full intent of the Contract. Additional copies of these drawings that may be required by the Contractor can be obtained from the Engineer; in which case the Contractor will be required to reimburse the cost of producing such additional copies.

The Engineer may from time to time in order to enable the satisfactory completion of the Works, revise, amend, or supersede any of these drawings. It shall be the Contractor's responsibility to construct all Works in conformity with the latest revision, amendment or superseding drawings, provided that the Engineer has given to the Contractor in writing such reasonable prior notices of intention to revise, amend or supersede as the nature of the intended change requires and the relevant drawings have been issued to the Contractor.

The Contractor may be required to demolish, alter and/or correctly rebuild at his own expense any part of the Works not in conformity with the drawings currently

forming part of the Contract at the time of construction of such Works, provided always that such current drawings had previously been issued to him.

1.3 **Standards**

In the Specifications, Bills of Quantities, and Drawings reference has been made to relevant British Standard Specifications and Codes of Practice – to which the materials and workmanship should comply with. However, the materials and workmanship complying with equivalent Kenya Bureau of Standards (K.E.B.S.) or International Standards Organisation (ISO.), for that particular material or workmanship will also be acceptable.

Mixture of different Standards in one trade will not be allowed. Standard, then all the pipes for the works are to be to ISO standard.

The Contractor may propose that the materials and workmanship be defined in accordance with the requirements of other equivalent Standards and the Contractor may execute the works in accordance with such other Standards as may be approved by the Engineer, A copy of the Standard, together with its translation into the English language if the Standard is in another language, shall be submitted to the Engineer with any request that it be adopted.

Where the dimension in one standard does not completely correspond to the dimension of the other standard, which is being used for construction of works, ruling of the Engineer will be sought and any decision given by the Engineer will be final and binding upon the Contractor.

1.4 **Programme of the Execution of Works**

In accordance with Sub clause 9.3 of the conditions of contract, the Contractor upon receiving Engineer's order to commence shall within 28 days draw up a working programme setting out order and method in which the works are to be carried out with appropriate dates thereof, together with delivery dates for materials. The Contractor shall together with his work programme supply an expenditure chart showing monthly anticipated expenditure.

If at any time it should appear to the Engineer that the actual progress of then Works does not conform to the programme referred to above, the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to the approved programme necessary to ensure completion of the Works within the time for completion as defined in sub clause 9.2 of the Conditions of Contract.

In addition the Contractor shall extract from the main program and provide a 90 days program showing works he intends to execute within every 90 day period and submit the program within the first week of each quarter.

The programme shall be deemed to have taken into account normal variations in climatic conditions to provide for completion of the works in the order and within the times specified therein.

The various operations pertaining to the Works shall be carried out in such a progressive sequence as well as will achieve a continuous and consecutive output of fully complete pipeline works inclusive of all appurtenances, treatment plants and all installations within the time limits specified in the Contract. Generally the Contractor shall progress continuously without leaving any isolated section

incomplete, provided that the land upon which the works are to be constructed has been acquired in the entirety and the encumbrances and services thereon removed.

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 in the prescribed order and by the prescribed completion date and he shall from time to time review his progress and make such amendment to his rate of executions of the works as may be necessary to fulfil these obligations.

Once the proposed programme is approved by the Engineer the Contractor shall not depart form the programme without the written consent of the Engineer. In the event of unforeseen difficulties or disturbances arising, which force the Contractor to depart from the approved Programme of Works, he shall advise the Engineer in writing of such occurrences without delay and submit proposals for any necessary remedial measures, for which he shall obtain the Engineer's approval before putting such measures into effect.

1.5 **Substantial (Practical) Completion**

Substantial or Practical Completion of Works is to be understood as a state of completion, which leaves out only minor outstanding items that can be readily completed within a period of less than 1 month without interfering with the normal operation of the Works.

The works will not be considered as substantially or practically completed without the works being capable of being used by the Employer in accordance with the purpose of the works.

1.6 **Method of Construction**

The Contractor shall submit to the Engineer not later than 28 days from the date of award of the Contract a general description of his proposed arrangement and method for execution of the works, including inter alia temporary offices, buildings, access roads, deviations, constructional plants and its intended production output, working shift arrangements, power arrangements, supply of materials, stone crushing, aggregates production and storage, cement handing, pipe handling and storage, Concrete mixing and handling, method of excavation, dealing with water, testing methods and facilities.

During execution of the works, the Contractor shall also submit to the engineer full and detailed particulars of any proposed amendments to the arrangement and method submitted in accordance with the foregoing.

The Engineer's Normal working hours shall be Monday to Friday 8.00 a.m. to 5.00 p.m. and Saturday 8am to 1pm. with all Public Holidays set aside as required. If the Contractor wishes to execute permanent works outside these hours, he shall obtain a written permission of the Engineer at least one full working day in advance to enable the engineer to make provision for supervision of such work.

1.7 **Notice of Operations**

No operation shall be carried out without full and complete notice having been given to the Engineer by the Contractor sufficiently in advance of the time of the operation to enable the Engineer to make arrangements as he may deem necessary for its inspection and checking.

The Contractor shall give the Engineer not less than 1 full working days' notice in writing of his intention to set out or give levels for any part of the works in order that arrangements may be made for checking.

1.8 **Nominated Sub-Contractors and Nominated Suppliers**

The Contractor shall be responsible for Nominated Sub-Contractors in every respect. In particular it shall be the Contractor's responsibility to ensure that each Sub-Contractor commences and completes the work in a manner so as to conform to the working progr amme, as specified above.

Sub-Contractors and Suppliers in the project area shall be given preference in sub-contracts as far as they meet the requirements for such sub-contracts.

It is also the responsibility of the contractor to ensure a satisfactory progress of the works and to ensure that the works are completed to a standard satisfactory to the Engineer.

The Contractor shall accept liability for and bear the cost of General and Specified Attendance on Nominated Sub-contractors which shall be deemed to include for:-

(i) Allowing the use of standing scaffolding, providing special scaffolding, maintenance and alteration of all scaffolding, retention of all scaffolding until such time as all relevant Sub-Contractor's works are complete and removal of all scaffolding on completion.

(ii) Providing equipment and labour for unloading and hoisting Sub-Contractor's materials.

(iii) Providing space for office accommodation, and for storage of plant and materials: allowing use of sanitary accommodation; the supply of all necessary water, power, lighting and watching and clearing away all rubbish.

Before placing any orders with nominated Sub-Contractors or nominated Suppliers, the Contractor should enter into an agreement with the nominated Sub-Contractor /nominated Suppliers to ensure that the conditions and delivery of materials to site comply with the Conditions of Contract and the working programme.

Particular clause should be inserted in the agreement with the nominated Suppliers ensuring the validity of the rates for the supply of materials as per the delivery schedule.

Nominated Suppliers who are unable to meet the delivery schedule will not be given allowance for any increases in prices incurred after the delivery time agreed in the delivery schedule.

1.9 **Entry upon Land, Working Site and Adjoining Lands**

The Employer shall provide land, right-of-ways and way-leaves for the Permanent Works specified in the contract only.

The Employer shall make available free of charge to the Contractor all land on, under or through which the permanent works are to be executed or carried out all as indicated in the book Drawings or as detailed in the Specifications. Such land shall exclude land required by the Contractor for his own camps, Borrow sites, offices, houses, temporary works or any other purpose.

The Contractor shall give notice to the Engineer at least 30 days before he wishes to enter on to the land required to carry out the permanent works under the Contract. The Contractor shall not enter on to any land or commence any operations until such time as he receives formal confirmation from the Engineer that all necessary compensation formalities have been completed and that permission has been obtained from the land owner to enter the land and commence operations. Should the Contractor enter on to any land and commence operations without first obtaining this confirmation, he shall be liable in whole or in part, at the sole discretion of the Engineer, for all additional costs and/or legal charges which might arise there-from.

The Contractor shall on his own accord obtain rights of admission, and rights of using all other areas which are necessary for storing and manufacturing or for setting up site offices and Resident Engineer's office or whatsoever will be necessary including borrow sites .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.

The Contractor shall take care to prevent injury, damage and trespass on lands, fences and other properties near and adjacent to the works and must in this connection make all necessary arrangements with adjoining landowners, or in the case of Government Property with officers appointed for this purpose, and ensure the workmen's observance of all Government rules and Ordinances regarding game protection and other matters and provide, maintain and clear away on completion of the Works all temporary fencing which may be required for execution of the Works.

Before completion of the Works the Contractor must make good or compensate any such injury, damage or trespass on lands, fences and other properties which have not otherwise been provided for in the Contract.

1.10 **Preservation of Survey Beacons**

Ordinance Survey Beacons, Benchmarks, etc., on or around the site of the Works shall not be disturbed unless permission has been obtained by the Engineer form the Survey of Kenya.

In the event of unauthorized disturbance of such beacons, benchmarks, etc., in the course of the Works being carried out the Contractor shall be responsible for reporting same to the Engineer and the Survey of Kenya and for payment of any fees due to said Survey of Kenya for replacement of such disturbed beacons, bench marks, etc. The Contractor shall not replace such disturbed beacons benchmarks, etc. on his own accord.

1.11 **Relocation of Existing Services**

Drains, pipes, cables and similar services encountered in the course of the Works shall be guarded from damage by the Contractor at his own costs to safe guard a continued uninterrupted use to the satisfaction of the owners thereof, and the Contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.

If the interests of the Works shall, in the opinion of the Engineer, so require, the Contractor shall on the Engineer's direction arrange for the construction of permanent or temporary diversions of the said drains etc., together with

reinstatement, if temporary, by the respective Department, Bodies, Corporations or Authorities and, the cost of such works or diversions including reinstatement shall be charged against the appropriate Provisional Sum provided in the Bills of Quantities.

It is the responsibility of the Contractor to inform the Engineer immediately any existing service is exposed.

1.12 **Damage to Existing Services**

The Contractor shall be held liable for all damage and interference to mains and pipes, to electric cables or lines of any kind either above or below ground caused by him or his Sub-contractors in execution of the Works, whether such services are located on the Contract Drawings or not. The Contractor must make good or report to the appropriate authorities the same without delay and do any further work considered by the Engineer or owner.

If the Contractor fails to reinstate the damaged services within the time considered as reasonable by the Engineer's Representative, then the Engineer's Representative shall be empowered to get the damaged services reinstated by any other contractor and charges thereof shall be deducted from any money due to the Contractor.

1.13 **Temporary Roads and Traffic Control**

The Contractor shall provide and maintain all temporary roads, bridges and other works to maintain free and efficient access to services affected by Construction of permanent works, the cost of necessary temporary traffic control signs, barricades, beacons, flagmen, lighting and watching required for the normal control of traffic. No payment shall be made for compliance of this item.

1.14 **Use of Public Roads**

Where a road used by the Contractor for delivery of any material used in the works is closed under Section 71 of the Traffic Ordinance Act 1962, the Contractor shall obey such closure order and use alternative roads.

The Contractor shall keep all roads used by his equipment and project vehicles in well maintained condition including watering and periodic grading/ gravelling as may be instructed by the Engineer from time to time. The items shall be provided in the Bills of quantities and the rate shall include watering, periodic grading, temproarly traddic control, traffic sisgns, barricades, flagmen, lighting and watching required for control of normal control of traffic.

1.15 **Road and Railway Crossing and Traffic Control**

Wherever the water pipeline is crossing the classified roads and railway line the Contractor will contact the relevant authorities well in advance and obtain necessary permission to dig across the road and railway line in accordance with requirement of the authorities concerned and shall pay any royalties connected with this work, and the Contractor will provide temporary detour road together with any warning signs necessary. There will be no separate payment for this and cost of all expenses connected with road and railway crossing for which no separate items have been included in Bills of Quantities is deemed to have been covered by the unit rates included in the Bills of Quantities.

1.16 **Protection from Water**

Unless otherwise mentioned the Contractor shall keep the whole of the Works free from water and allow in his rates for all dams, coffer dams, pumping, piling, shoring, temporary drains, sumps, etc. necessary for this purpose and shall make good at his own costs all damage caused thereby.

1.17 **Weather Conditions**

The Contractor shall be deemed to take into account all normal weather conditions when preparing his tender and he shall not be entitled for extra payment by the reason of the occurrence or effect of high winds, excessive rainfall, temperature or any other meteorological phenomena occurring during normal seasons in Kenya.

1.18 **Protection from Weather**

All materials shall be stored on site in a manner approved by the Engineer's Representative and the Contractor shall carefully protect from the weather all works and materials which may be affected thereby.

No separate payment will be made for this and the Contractor will allow in his rates for this.

1.19 **Explosives and Blasting**

For works requiring the use of explosives, the Contractor shall employ men experienced in blasting, and these men must be in possession of a current blasting certificate. The purchase, transport, storage and use of explosives shall be carried out in accordance with the most recent explosives Ordinance and Rules issued by the Government of Kenya and the Contractor shall allow in his rates for excavation and quarrying for all expenses incurred in meeting these requirements, including the provision of suitable stores. Blasting operations shall be carried out with as little interference as possible to traffic or persons.

In all cases permission from the Engineer must be obtained before commencing any blasting operation. Such approval shall not relieve the Contractor from his responsibility for the damage of the works and adjoining or adjacent structures, roads, places and things, injury, loss, inconveniences and accidents to persons, animals and property consequent on the use of such explosives. The Contractor shall be entirely liable for any accident which shall occur and shall save the employer harmless and indemnified from all claims arising therefrom.

If, in the opinion of the Engineer, blasting would be dangerous to persons or property, or it is carried out in a reckless manner, the Engineer can prohibit any further use of explosives without entitling the Contractor to any extension of time occasioned by corresponding delays.

1.20 **Liaison with Police and Labour office**

The Contractor shall keep himself in close contact with the Police, Labour Officers and other officials of the areas concerned regarding their requirements in the control of workmen, passage through townships, or other matters and shall provide all assistance and/or facilities which may be required by such officials in execution of their duties in connection with the Works.

Any instruction given by the Traffic Police concerning fencing off of open trenches or other excavations must be followed explicitly.

1.21 **Provision of Water**

The Contractor shall provide water for use in the Works. He shall supply all hydrants, hose, cocks, vessels and appliances necessary for the distribution thereof and shall provide pumps, tanks, carts, vessels and appliances, transport and labour when and wherever it is necessary for water to be carted for use at the Works. All water used in connection with the Works shall if possible be obtained from a public water supply and the Contractor shall make all necessary arrangements and pay all the charges for connections to main and for water used. No separate payment will be made for this and the Contractor will allow in his rates for this.

1.22 **Temporary Lighting and Power**

The Contractor shall provide all artificial lighting and power for use on the Works, including all Sub-Contractors' and Specialists' requirements and including all temporary connections, wiring, fittings, etc., and clear away on completion. The Contractor shall pay all fees and charges and obtain all permits in connection therewith. No separate payment will be made for this and the Contractor will allow in his rates for this.

1.23 **Sanitation**

The Medical Officer of Health or other Sanitary Authority shall be informed when Works are about to commence. The instructions of the Medical Officer or other Sanitary Authority shall be complied with by the Contractor at his own expense.

The site shall be kept in a clean and proper sanitary condition. No nuisance shall be committed on or around the work, and latrines for the workmen and staff shall be provided in accordance with the requirements of the Medical Officer or Sanitary Authorities. The Contractor shall be responsible for the sanitary discipline of his labour.

The Engineer's Representative has the right to order any labourer, who in the opinion of the Engineer's Representative does not have a satisfactory sanitary discipline, off the site with immediate effect.

The Contractor shall follow the safety rules set down by the Factories Inspectorate, Ministry of Labour. No separate payment will be made for this and the Contractor will allow in his rates for this.

1.24 **Safety Officer**

Contractor's attention is drawn to Legal Notice No. 79 of 22nd September 1978 by which it is mandatory that every Contractor employing more than twenty people should appoint (in writing) a safety supervisor. A safety supervisor advises the management on all matters regarding safety, hygiene and welfare of the people affected by the Contractor's undertaking on the site. The safety officer may in addition carry out other duties.

The contractor shall provide adequate first-aid equipment on the site, and ensure that at least four of his site staffs are competently trained in first-aid. No separate payment will be made for this and the Contractor will allow in his rates for this.

1.25 **Signboards**

The Contractor shall provide, erect and maintain signboards to the layout, colours material and dimensions shown on the drawings.

The Contractor shall erect 4No.Signboards as shown on the drawings in prominent positions adjacent to the Works to the satisfaction of the Engineer. These signboards shall be erected at sites to be selected by the engineer.

The signboards are to be erected within one month of the date of commencement of the contract. The Contactor shall remove the signboard at the end of the period of the maintenance

Two addition special Permanent signboards shall be erected at the end of the Contract clearly showing the project name and the Employer's name to the satisfaction of the engineer.

1.26 **Setting Out**

The Contractor must before commencing any construction work, make sure that levels shown in the drawings correspond with levels found on the site.

Should any discrepancy be discovered between the levels shown on the drawings and those found on the site, which may affect the levels and dimensions of any part of the Works, the Contractor shall notify the Engineer, who, if necessary, will issue drawings showing the amended levels and dimensions.

The Contractor shall clear the site and set out the Works well in advance to enable the Engineer to inspect and approve the setting out prior to commencement of the Works. The Contractor shall amend at his own cost any error due to inaccurate setting out.

Any checking or approval by the Engineer of the setting out, benchmarks, plans or schedules will not relieve the Contractor of his responsibilities under the Contract.

The Contractor shall provide a site plan showing the position of his site offices, storage sheds, accommodation, Engineer's Representative's office etc., in relation to the permanent works for the approval of the Engineer before commencing erection of his camp.

After completion of the setting out and site clearance, the Contractor shall take ground cross sections along the pipeline at 25m interval and along the centreline of all structures. These shall be plotted in A3 paper, agreed and signed by the Engineer's Representative and Contractor prior to commencement of any excavation works and shall be used for measurement.

1.27 **Backfilling of Holes and Trenching for Temporary Works**

The Contractor shall immediately upon approval of any work at his own expense and to the satisfaction of the Engineer backfill all holes, trenches and temporary quarries which have been made , level all mounds or heaps of earth that may have been raised or made and clear away all rubbish caused by the execution of the work. The Contractor shall bear and pay all costs, charges, damages, and expenses if any kind whatsoever which may occur by reason of holes and trenches connected with the Works or materials or tools or plant being left or placed in improper situation.

1.28 **Inspection of Works**

No part of the Works shall be built in or covered over until it has been inspected and approved by the Engineer and the Contractor must give due notice in writing to the Engineer's Representative when any part of the Works are ready for inspection.

1.29 **Joint Measurements**

All measurements shall be taken jointly by the Contractor and the Engineer as and when the latter so directs and shall be made in accordance with the Specification and Preamble to Bills of Quantities notwithstanding local or other customs.

1.30 **Cleaning up of Site**

The Contractor shall keep the site clean during the entire contract performance period. And before final acceptance upon the completion of the Works the Contractor shall, at his own expense, remove and dispose of all rubbish and remove all equipment, surplus materials, camps and buildings, which the Contractor has provided, and temporary works ordered by the Engineer and shall leave the Site absolutely clear thereof and in good order and condition to the entire satisfaction of the Engineer.

1.31 **Testing of Water-Retaining Structures**

All water-retaining structures shall on completion be tested for water-tightness in the following manner. The structure shall be filled with potable water in stages and held at each stage for such time as the Engineer may require. Should any dampness or leakage occur at any stage the water shall be drained off and the defects made good. The procedure shall be continued and finally the structure shall after a period allowed for absorption remain full for seven days. Within those seven days the level of the surface of the water should be recorded and measurements made at intervals of 24 hours. The total leak must not exceed 0.3% of the total volume of water in the tested structure.

If the structure does not satisfy the conditions of the test, and the daily drop in water level is decreasing, the period of test may be extended for a further 7 days, and, if the specified limit is then not exceeded, the structure may be considered as satisfactory.

Should any dampness or leakages or other defects occur they shall be made good and the structures re-tested until the water-tightness is approved by the Engineer.

Faces of submerged structures may not be covered before testing.

The Contractor shall allow in his rates for all expense and shall provide water and all necessary labour and materials for testing the structure.

1.32 **Testing of Roofs**

Where structures are used for the storage of potable water, adequate precautions should be taken to ensure that the roof is watertight in order to give protection against a potential source of pollution.

The roof should be tested by lagooning the concrete slab to a minimum depth of 75mm for a period of 3 days; the roof slab should be regarded as satisfactory if no damp patches occur on the soffit. The roof screed should be completed immediately after testing.

All water, labour and materials for the test are to be provided by the Contractor who shall allow for this in his rates.

1.33 **Cleaning and Sterilising Water-Retaining Structures**

The interior of all potable water-retaining structures shall be thoroughly cleaned and washed after the water-tightness test has been approved by the Engineer in order to remove all contamination.

The structure shall then be filled to overflow level with clean water containing 50 parts per million of chlorine and left for a period of at least 24 hours. The chlorinated water shall then be drained away and the structures refilled with clear water from which samples shall be taken for bacteriological examination and for tests of residual chlorine. If any of the results of the tests are unsatisfactory when compared with those of the control sample of the supply water the sterilizing process shall be repeated until the results of the tests are satisfactory.

The Contractor shall allow for in his rates: providing water, all labour, materials, chemicals and other things necessary for cleaning and sterilizing the water-retaining structures.

1.34 **Sampling and analysis of Clean Water in the System**

The costs of the initial sampling, analyses and preparing reports on the bacteriological quality of the water shall be borne by the Employer, but should the initial reports be unsatisfactory the costs of any subsequent sampling analyses and preparing reports shall be borne by the Contractor.

1.35 **Contractor's Superintendence**

The Contractor shall give or provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor or his competent and authorized Agent or Representative approved in writing by the Engineer (which approval may at any time be withdrawn) is to be constantly on the Works and shall give his whole time to the superintendence of the same. If such approval shall be withdrawn by the Engineer, the Contractor shall after receiving written notice or such withdrawal; remove the Agent from the Site within the time stated in the notice and shall replace him by another Agent approved by the Engineer.

1.36 **Transport of Workmen**

The Contractor shall include in his rates for all transport of staff and workmen to and from and in connection with the various parts of the Works, and all costs incurred in recruiting and transporting labour to the site, where such labour is from outlying areas and costs of returning labour on termination of the Contract.

1.37 **Normal Working Hours**

These shall be taken as Monday to Friday 8.00 a.m. to 5.00 p.m. and Saturday 8am to 1pm. with all Public Holidays set aside as required. The Contractor shall allow for observance of Sabbath or any other religious days to his staff.

Where the Contractor wishes to work outside these hours he shall request the Engineer in writing at least 24 hours in advance for consideration. The Contractor shall bear the cost of overtime for all Engineer's support staff associated with such works.

1.38 **Accommodation for Contractor's Workmen**

The Contractor shall provide and maintain suitable shelters and mess facilities for his workmen and supervisory staff. The facilities shall be of sufficient size and to a standard considered satisfactory by the Engineer.

The Contractor shall throughout the contract provide an adequate supply of potable water for the Workmen.

1.39 **Storage Space: Sheds**

Suitable temporary stores and workshops shall be erected and later removed on completion of the works. All buildings shall be adequate for protection of the equipment of materials to be kept therein and shall be constructed and located to the satisfaction of the engineer.

1.40 **Office for the Contractor**

The Contractor shall erect an office near the Works on a site to be approved by the Engineer. This office shall be kept open at all hours during which the work is in progress.

Any notice to be given to or served upon the Contractor shall be deemed and taken to be effectively given or served upon by the delivery thereof at such office on the Site.

1.41 **Communication**

The Contractor shall, if so instructed by the Engineer, provide mobiles phones and airtime as necessary for the duration of the contract and, VSAT internet connection, post office, courier, radio communication for the exclusive use of the Engineer. The model and make of the mobiles phones shall be approved by the Engineer.

Failure by the Contractor to provide or maintain the same shall make him responsible for all costs that may be incurred as a result of the Engineer's staff using alternative means of communication, including delays in supervision and approval of the works.

Payment for complying with this requirement is included in the bill of quantities.

1.42 **Houses, Office, Laboratories for the Engineer's Staff and Time for erection**

The Contractor shall provide and maintain houses, offices, laboratories, survey and laboratory equipment and furniture for the Engineer and his staff including senior staff, junior staff and technicians

All houses, offices and laboratories to be provided under the contract shall be handed over to the engineer in finished and fully habitable condition not later than **sixty days** after Engineer's order to commence work (Clause 9.1 of the General Conditions of Contract)

No construction of the any works will be permitted until the engineers offices and laboratories have been accepted by the engineer as finished and able to function efficiently.

Should the Contractor fail to hand over the houses, offices, and laboratories within the period specified, the engineer will make such arrangements as he considers necessary. These arrangements may include use of hotels, rented accommodation, and the hire or purchase of caravans, port-cabins etc. the contractor will be

responsible for all costs of such temporary arrangements made by the engineer, including that of additional cost of transport.

Any delays to the Contractor or the Contractor's activities caused by the Engineer being unable to perform survey work, field or laboratory tests due to the Contractor's failure to supply and/or maintain the said equipment, houses and accommodation shall be deemed to have been caused by the Contractor's own actions, and any consequences of such delays shall be interpreted as such.

1.42.1 Housing Accommodation for the Engineer's Senior Staff

The Contractor shall construct, equip and maintain houses (Two for type I and Five for type II or equivalent) for the Engineer's senior staff. The Engineer's senior staff houses shall be separate from that of the Contractor's staff housing and shall be sited and constructed to the satisfaction of the Engineer as detailed in the Drawings.

Type I and II Houses shall be in accordance with the book of drawings, and shall be constructed with material to be approved by the Engineer. The Engineer shall approve the design and construction of the same. These houses shall revert to the Contractor at the end of the project. They shall be paid for in accordance with Clause 1.50 of this Specification, under Bill items 1.04 of the Bill of Quantities.

All material used shall be new, strong, durable and weatherproof. Ceilings and floor must be properly insulated against heat with approved insulated material. The floor shall have a level smooth finish. All windows shall be glass, able to be opened, and with mosquito nets. The building materials shall be mosquito and termite proofed and painted in and outside with two coats of paint/ varnish, all to the approval of the Engineer.

The ceilings of houses and verandas shall be lined with ceiling board. All doors are to be fitted with mortise locks, which must be heavy duty on external doors. All windows shall be fitted with burglar bars.

The roof cladding shall be with G.I. corrugated sheets or equivalent material. The lounge, bedroom, bathroom, toilet and kitchen floor will have cement mortar finish floors. The workbenches in kitchen shall have approved cover. All the sanitary ware shall be vitreous China or equivalent of approved quality.

All houses are to be provided with a fire extinguisher and fire axe. Fire axes are to be secured to the outside of the buildings.

All storerooms shall be fitted with at least 3 substantial shelves and kitchens shall be fitted with shelves, drawers and cupboards as instructed.

The Contractor shall provide new furniture, equipment and fittings as listed herein below. The Contractor should obtain approval of the Engineer for the type and quality of the furniture, fittings and equipment before ordering.

All houses shall be provided with a piped supply of drinkable water, electricity, gas and kerosene for the consumption of the Engineer and his staff and the Contractor shall provide all necessary waterborne sanitation and disposal systems to the satisfaction of the Engineer.

The Contractor shall pay for water, electricity, gas and kerosene consumed, and for the statutory charges associated therewith. The Contractor shall be responsible for rubbish disposal by providing outside bins and daily collection to a central area located to the satisfaction of the Engineer.

Each type I and II house shall be erected separately. A barbed wire topped chain link wire fence 2 metres high with a chain and padlock lockable gate shall be provided around the general perimeter of the types I and II houses.

Each type I and II house shall be provided with day and night watchmen and security lights, the cost of which shall be deemed to have been included in the rates for the houses.

This senior staff will generally comprise the following:

Designation	**Number**
Resident Engineer	1
Materials Engineer	1
Engineering Surveyor	1
Assistant Resident Engineer Structures	1
Assistant Resident Engineer Water	1
Assistant Resident Engineer Electro-Mech.	1

1.42.2 Housing Accommodation for Engineer's Junior Staff

The Contractor shall construct, equip, furnish and maintain 5 No. Type III and 18 No. Type IV houses or equivalent for the Engineer's Junior staff, to be located adjacent to Resident Engineer's offices and laboratory, the location of which will be subject to Engineer's approval.

Junior staff houses shall be temporary and made in durable and weatherproof materials and to a similar standard as the senior staff houses.

House Types III and IV including furniture and fittings shall all revert to the Contractor on completion of contract. They shall be paid for in accordance with Clause 1.50 of this Specification, under Bill items 1.01 of the Bill of Quantities.

This staff will generally comprise the following:

Designation	**Number**

Surveyor	2
Draftsman	1
Senior Lab Technician	1
Administration Assistant	1
Draughtsman	1
Secretary	1
Assistant Surveyor	2
Assistant Draughtsman	1
Inspector	6
Lab Technician	4
Leveller	2

1.42.3 Engineer's Offices

The Contractor shall construct and maintain for the duration of the Contract, a furnished and equipped main office for the Engineer's Representative of durable and weather-proof construction, provided with mosquito-proof and burglar-proof windows and lockable doors and suitably insulated against heat and cold, all to the satisfaction of the Engineer in respect of the construction, design and sitting. The office shall comply with the details shown in the drawings and shall have a clear height of not less than 2.6 m. The floor shall be of floated concrete, and adequately damp- and termite-proof.

A telephone shall also be provided for the Resident Engineer's office for his exclusive use. The Contractor shall be responsible for paying all the charges and fees related to the use of the telephone and be reimbursed the same on production of proof of payment.

The office for the Engineer's Representative shall be completely separate from that of the Contractor and shall be fenced with a 2m high chain linked fence and gate with padlock and chain.

Toilets and washrooms graded to staff seniority, together with drinkable water supply and water borne sewage disposal, shall be provided for the office. The Contractor shall also provide 24 hours a day electricity supply to the offices and shall allow for any water and electricity consumed and for any statutory charges associated.

Unless the offices are accessible via an existing paved road the Contractor shall also provide an access road at least 4m wide to the office. A 100 square meters covered car parking area. Both access road and car park shall be surfaced with at least 150 mm of consolidated gravel properly graded, cambered, drained and culverted.

The offices shall be provided with day and night watchmen and security lights, the cost of which shall be deemed to have been included in the rates for the offices.

1.42.4 Laboratory

The Contractor shall construct, and maintain for the duration of the Contract, a laboratory complying with details shown on the standard drawing or equivalent, to the satisfaction of the Engineer. The building shall be of durable and weatherproof materials, provided with mosquito-proof and burglar proof windows and lockable doors, and suitably insulated. The laboratory shall be sited adjacent to the Resident Engineer's main office.

The laboratory shall have piped potable water supply and a continuous electricity supply adequate for lighting, heating and operating the laboratory equipment.

The laboratory shall have a height from floor to ceiling of not less than 2.75 metres and all rooms shall be fitted with electric lighting and power points as instructed by the Engineer's Representative, and each door shall be fitted with a good quality mortise lock and provide with two keys.

Soaking tanks for Concrete Cubes specimens shall be provided at floor level in the laboratory. Concrete cube curing tanks of adequate size shall also be provided. The concrete cube curing shall have drainage pipes built in.

The following rooms and facilities shall be provided in the Laboratory;

(i) Office

This room shall have a total floor area of not less than 14 square metres and a total window area of not less than 2 square meters. The door and windows shall be fitted with fly screens covered with mosquito gauze. The floor shall be of concrete with a float finish. The walls shall be lined and ceiling provided.

A display board of soft-board or similar approved material shall be provided and fixed securely to the wall at a location to be indicated by the Engineer.

(ii) Main laboratory room

This room shall have a total floor area of not less than 55 m^2 and a total window area of not less than 7 m^2. The external entrance shall be a double door and single doors shall be provided for access to adjacent offices.

The permanent fixtures in the Laboratory shall include three double draining board stainless steel sinks, piped potable water supply to each and waste water outlets. The room shall be fitted with three rigidly constructed work benches 0.9 m high by 1 m wide and with a top comprised of either metal lined hardwood or steel float finished concrete (at least 75 mm thick and suitably reinforced). A total length of workbenches approximately of 15 m shall be provided. Wall shelves 450 mm wide and having a surface area of at least 6 m^2 shall be provided and securely fitted.

Concrete plinths suitable for mounting the cube crusher and CBR load frame shall also be provided.

Two display boards made of soft-board or other approved material, each with a minimum area of 3 m^2, shall be securely fixed to the walls as directed by the Engineer.

(iii) Small laboratory room

A small laboratory room shall be provided. This room shall have a total floor area of not less than 20 m^2 and a total window area of not less than 2 m^2. A door shall provide access to the main laboratory room. The floor shall be fitted out as indicated by the Engineer's Representative with two rigidly constructed workbenches constructed to the same standard of construction as the main laboratory room. The workbenches shall be at least 6 m long. A sink with waste pipe shall be connected to the water supply of the main laboratory room in addition an approved air extractor shall be fitted through an outside wall.

(iv) Store room

A separate sample store, of at least 20 m^2 floor area and with shelves along one wall, shall be provided in a position to be indicated by the Engineer.

(iv) Concrete slab

A concrete slab, 150 mm thick with a total area of not less than 20 m^2 shall be provided adjacent to the main laboratory building in a position to be indicated by the Engineer's Representative. The slab shall have a smooth finish, all to the satisfaction of the Engineer. The laboratory shall revert to the Contractor at the end of the contract.

1.42.5 Engineer's housing, office and laboratory furniture

Furniture and equipment for the Engineer's Laboratory shall be as listed **appendix of this specification**. It shall also be the Contractor's responsibility to replenish consumables, when instructed by the Engineer. The Engineer's Housing, office and laboratory furniture will revert to the Contractor on completion of the contract.

1.42.6 Engineer's laboratory and survey equipment

The Contractor shall provide, install and maintain in a good state of repair for the duration of the Contract, such laboratory, survey and other equipment as listed **in the appendix of this specification** Such equipment shall be of approved manufacture, and shall be made available to the Engineer within the following time periods:

- *Survey equipment - not more than 30 days after Engineer's order to supply*
- *Laboratory equipment - not more than 60 days after Engineer's order to supply*

Any delays to the Contractor or the Contractor's activities caused by the Engineer being unable to perform survey work, field or laboratory tests due to the Contractor's failure to supply and/or maintain the said equipment shall be deemed to have been caused by the Contractor's own actions, and any consequences of such delays shall be interpreted as such.

The laboratory and survey equipment shall revert to the Employer on completion of the contract.

1.43 Maintenance of the Engineer's Staff Houses, Offices, Laboratories, Furniture and Equipment

The Contractor shall keep all buildings, accesses, services and facilities provided by him, for the use of the Engineer and his staff, in a well maintained, clean and fully habitable condition, 24 hours per day until the issue of the Taking Over Certificate for the whole of the Works, and if required for a period thereafter until the Contractor has completed any outstanding work.

The Contractor shall also provide constant electricity, water and an adequate refuse collection service for all houses, offices and laboratories.

The Contractor shall also maintain all furniture and equipment provided by him and/or the Employer in a reasonable state of repair and useable condition and shall replace promptly any item which becomes unserviceable or is lost.

1.43.1 Provision of Maintenance and Security

The contractor shall provide cleaners, groundsmen, and day and night watchmen for housing camp and offices as directed or instructed by the Engineer on site, the cost of which shall be included in the rates for providing houses, offices and laboratory.

1.44 Insurance and ownership of the Engineer's Staff Houses, Offices, Laboratories, Furniture and Equipment

All buildings, furniture and equipment provided by the Contractor for the Engineer's staff shall be insured by the Contractor against loss or damage by accident, fire, theft and other risks ordinarily insured against for the duration of the Contract.

On completion of the contract the ownership of the office, laboratory and survey equipment shall revert to the employer. Unless otherwise stated ownership of all houses and laboratories shall revert to the contractor.

1.45 Provision of Vehicles

All vehicles to be supplied will be brand new, right hand drive, diesel powered and fitted with air-conditioner and power steering as described below.

Type 1. - new Turbo diesel propelled 4WD, 5 door 7-seater station wagon vehicle of minimum engine capacity 4164cc, 285Nm/2200rpm torque, 96kW/3800rpm power, 130ltrs fuel tank capacity fitted with all the necessities mentioned in paragraph one of this clause for the exclusive use of the Engineer.

Type 2. - new Turbo diesel propelled 4WD, 4 door 5-seater Double Cabin pick up vehicle of minimum engine capacity 4164cc,285Nm/2200rpm torque, 96kW/3800rpm power, 130ltrs fuel tank capacity fitted with all the necessities mentioned in paragraph one of this clause for the exclusive use of the Engineer.

Type 3. - new Turbo diesel propelled 4WD, 5 door 7-seater station wagon vehicle of minimum engine capacity 3000cc fitted with all the necessities mentioned in paragraph one of this clause for the exclusive use of the Engineer.

Type 4. - new turbo diesel propelled 4WD, 4 door 5-seater double cabin Pick Up vehicles of minimum capacity 2800cc, fitted with all the necessities mentioned in paragraph one of this clause for the exclusive use of the Engineer.

Type 5. - new turbo diesel propelled 4WD, 2 door 2-seater single cabin Pick Up vehicles of minimum capacity 2500cc, fitted with all the necessities mentioned in paragraph one of this clause for the exclusive use of the Engineer.

1.45.1 Contractor's Vehicles for the Engineer's use

The Contractor shall supply new vehicles and maintain them for the exclusive use of the Engineer and his staff, for any purpose whatsoever authorised by the Engineer.

A description of the Number and the types of vehicle to be provided is given the bill of quantities.

The vehicles supplied for use by the Engineer's staff on site shall be owned by the Contractor and be licenced (inspection sticker) and comprehensively insured by the Contractor for use within Kenya by licenced driver authorised by the Engineer together with authorised passenger and the carriage of goods and samples. The contractor shall pay all tolls, provide fuel, oil, maintenance including replacing defective parts, tyres and the like whenever required, in conformity with the vehicles manufacturer's recommendations or as may be necessary. The vehicles shall be fuelled, oiled and maintained as aforementioned until released by the Engineer.

The vehicles on being released shall revert back to the Contractor. Each vehicle shall be fitted with fire extinguisher, first aid kit, tow hook and rope, tool kit, spare wheel, wheel wrench, jack and handle and seat belts all of which shall be maintained in working order or replaced by the contractor as necessary.

1.45.2 Employer's Vehicles

The Contractor shall supply new vehicles and maintain them for the exclusive use of the Employer's staff. A description of the Number and the types of vehicle to be provided is given the bill of quantities.

The vehicles supplied for use by the Employer shall be exclusively owned by the Employer and be licenced (inspection sticker) and comprehensively insured by the Contractor for use within Kenya. The contractor shall pay all tolls, provide maintenance that includes replacing defective parts, tyres and periodic general servicing of the vehicle whenever required, in conformity with the vehicles manufacturer's recommendations or as may be necessary. The vehicles shall be maintained as aforementioned until the end of the contract. Each vehicle shall be fitted with car track as approved by the Engineer, fire extinguisher, first aid kit, tow hook and rope, tool kit, spare wheel, wheel wrench, jack and handle and seat belts all of which shall be maintained in working order or replaced by the contractor as necessary till the end of the Contract. The Contractor shall provide a similar replacement for any vehicle out of service for more than 24 hours.

1.46 **Removal of Camps**

On the completion of the Contract, the Contractor shall if so requested take down and remove all structures connected with his camp, and shall take up all pipes, drains and culverts, backfill trenches, fill up all latrine pits, soak ways and other sewage disposal excavations, and shall restore the site as far as practicable to its origin condition and leave it neat and tidy to the satisfaction of the Engineer.

1.47 **Site Meetings**

Site meetings will be held monthly, but will be called for whenever the progress of the works so require or when demanded by the Engineer.

The Contractor shall at all meetings be represented by a responsible representative other than the Site Agent, who has the powers to commit the Contractor in all matters concerning the contract.

In the event no responsible representative of the Contractor is present at the meetings, any decision take by the Engineer at the meeting will be binding upon the Contractor.

1.48 **Miscellaneous Accounts**

The Contractor may be instructed by the Engineer to make payments of general receipted accounts for such items as stationery, stores, furniture and equipment, claims and allowances for supervision personnel and any miscellaneous claims or the Engineer may direct the Contractor to purchase or pay for the above. The Contractor will, on provision of receipts, be paid under appropriate items in the Bill of Quantities

1.49 **Payment of Overtime for Engineer's Junior Staff**

The Contractor may be instructed by the Engineer to make payments for overtime worked by the Engineer’s junior staff. The Contractor shall be reimbursed for such payments in accordance with the relevant items of the clause 1.50 of this specification except when any overtime worked by the engineer’s junior staff is incurred by the need for the engineer to inspect work which, owing to earlier default by the contractor, has resulted in such work being performed outside the normal working hours as defined in clause 1.37 of this specification then the full cost of such overtime including the specified percentage for administrative overheads shall be paid by the Contractor to the Engineer.

(i) If the Contractor wishes to execute permanent work outside the Engineer's normal working hours, as stated in Clause 1.37 of this Specification, then the payment for the overtime for Engineer's support staff shall be reimbursed in full by the Contractor to the Engineer. For purposes of this clause, in addition to the support staff provided by the contractor, the following shall also constitute part of the Engineer’s junior staff

Designation	Number
Survey assistants/leveller	4
Senior lab Technologist	1

Lab Technologist	4
Inspectors	6
Draftsman	1
Secretary/Typist	1
Clerk	1

(ii) If the Contractor wishes to execute permanent works on a regular basis outside the Engineer's normal working hour, (Clause 1.37 of this Specifications) over a prolonged period, the Engineer may, if he deems it necessary, employ additional supervisory staff for which the required salaries, plus twenty (20) percent additional amount to cover for the Engineer's overheads shall be reimbursed in full by the Contractor to the Engineer and the Contractor shall provide the required accommodation facilities for such staff at his own cost.

(iii) Payment of Allowance on Duty Trips. The Contractor is required to pay for hotel accommodation and allowances for his staff seconded to the Engineer on official duty trips outside the base camp.

The Contractor shall not be reimbursed any of these costs (i.e. i,ii,iii)

1.50 **Measurement and payment**

No separate measurement and payments shall be made for the cost of complying with the requirements of clauses 1.1 to Clause 1.10, Clause 1.12, Clause 1.14 to Clause 1.33, Clause 1.35 to Clause1.40, Clause 1.43, Clause 1.44, Clause 1.46, Clause 1.47 and Clause 1.50 of this specification and the Contractor shall be deemed to have allowed elsewhere in his rates and price for all such costs.

a. No Preliminary item has been included in this Contract. All Contractor's mobilisation and general costs shall therefore be included in relevant rates in the Bill of Quantities.

b. Clause 1.11: Relocation of Existing Services

Unit: Prime Cost

Plus % for Contractors overheads and profits

Reimbursement for the removal of or alteration to existing services which are affected by the works shall be on a prime cost basis plus a % for overheads and profits. This percentage shall be deemed to include for all costs incurred in liaising with the appropriate bodies and for programming and coordinating work to enable any removal or alteration to the service to be carried out and complying with the requirements of clauses 1.11 and clause 1.20 of this specification.

c. Clause 1.14: Use of Public roads

Unit: Provisional Sum

Reimbursement for use and maintenance of public roads, and other works required for construction of permanent works shall be on a provisional cost basis and payments shall be on daywork basis. This costs incurred shall

include for liaising with the appropriate bodies and for programming and coordinating work and complying with the requirements of Clause 1.14, Clause 1.15, and Clause 1.20 of this specification.

d. Clause 1.25: Signboards

Unit: No. of each type

The rate shall include the cost of complying with clause 1.25 and costs incurred in liaising with the appropriate bodies and levies as may be applicable under relevant local and national laws.

e. Clause 1.34: Sampling and analysis of clean water in the system.

Unit: Prime Cost

Plus % for Contractors overheads and profits

Reimbursement for the costs of the initial sampling, analyses and preparing reports on the quality of the water shall be on a prime cost basis plus a % for overheads and profits. This percentage shall be deemed to include complying with the requirements of Clause 1.33 and Clause 1.34 of this specification.

f. Clause 1.41: Engineer's Communication.

Unit: Prime Cost

Plus % for Contractors overheads and profits

Reimbursement for the costs of providing and maintaining mobiles telephones, VSAT internet connection, post office, courier, radio communication shall be on a prime cost basis plus a % for overheads and profits. This percentage shall be deemed to include for all costs incurred in liaising with the appropriate bodies for licensing, registering, erecting and maintenance of the communication services and the cost of complying with the requirements of Clause 1.42 of this specification.

g. Clause 1.42.1Housing Accommodation for Engineer's Senior Staff :

Unit: No. of each type

Engineer's Senior Staff houses shall be measured by the number instructed to be built. The rate of the Engineer's Senior Staff houses shall include for the cost of providing the accommodation, electricity, water, telephone charges and heating in accordance with instructions issued by the Engineer and shall comply with the requirements of Clause 1.42 and Clause 1.43 of this specification.

Payment for the engineer's staff houses shall be made in instalments in accordance with the following conditions:-

(i) 50% (fifty percent) of the sum when the housing, office and laboratory, as appropriate, have been erected, furnished, equipped, accepted and handed over to the Engineer.

(ii) 50% (fifty percent) of the sum in equal monthly instalments spread -over the period from the date when the houses, offices, or the laboratory as appropriate is taken over by the Engineer until the end of the Contract excluding the Maintenance Period.

This payment shall be deemed to cover servicing and maintenance of buildings, furniture, equipment and services and the Engineer may withhold or reduce any instalments if the Contractor fails in his maintenance obligations. In the event of the Interim Certificate not being issued in any month, then the instalment shall be added to the subsequent certificate.

h. Clause 1.42.2 Housing Accommodation for Engineer's Junior Staff :

Unit: No. of each type

Engineer's junior staff houses shall be measured by the number instructed to be built. The rate of the Engineer's junior staff houses shall include for the cost of providing the office, electricity, water, telephone charges and heating in accordance with instructions issued by the engineer and shall comply with the requirements of Clause 1.42 and clause 1.43 of this specification.

Payment for the engineer's junior staff houses shall be made in instalments in accordance with clause 1.50 (g) of this Specification.

i. Clause 1.42.3 Engineer's Office :

Unit: No.

Engineer's office shall be measured by the number instructed to be built. The rate of the Engineer's office shall include for the cost of providing the office, electricity, water, telephone charges and heating in accordance with instructions issued by the engineer and shall comply with the requirements of Clause 1.42 and clause 1.43 of this specification.

Payment for the engineer's office shall be made in instalments in accordance with clause 1.50 (g) of this Specification.

j. Clause 1.42.4 Laboratory :

Unit: No.

Laboratory shall be measured by the number instructed to be built. The rate of the Laboratory shall include for the cost of providing the office, electricity, water, telephone charges and heating in accordance with instructions issued by the engineer and shall comply with the requirements of Clause 1.42 and Clause 1.43of this specification.

Payment for the Laboratory shall be made in instalments in accordance with clause 1.50 (g) of this Specification.

k. *Clause 1.45.1 Contractor's Vehicles for the Engineer use*

i) Unit: V. month for each type of vehicle

Provision of vehicles for the engineer shall be measured by the vehicle month (V. month) for each month, or part thereof, that the vehicle is provided for the engineer.

Payment for the vehicles (up to 4,000km per Veh.month) shall be by vehicle months.

ii) Units : Kilometers

Payment for mileage above 4,000km per vehicle month shall be at a rate per kilometer. The rate shall include for all fuels, lubricants, servicing insurance, maintenance, driver and repairs. The km rate shall include any overtime the driver might be due or any other allowances in addition to the normal working hours. Payment shall be under appropriate items in the Bill of Quantities.

In addition, the rate for running costs of vehicles shall also include:

(i) Cost of any repairs necessary as shall be required to meet roadworthiness and compliance with registration requirements

(ii) Any other repairs as shall be instructed by the Engineer

The rate shall include for the cost of complying with the requirements of clause 1.45 of this specification.

l. ***Clause 1.45.2 Employer's Vehicles***

i) Unit: No. of each type

Provision of vehicles for the employer's exclusive use shall be measured by the number of each type of vehicle provided.

ii) Units : Kilometers

Payment for each kilometre travelled by the vehicle per month shall be at a rate per kilometer. The rate shall include for all fuels, lubricants, servicing insurance, maintenance and repairs. The rate shall include for the cost of complying with the requirements of clause 1.45 of this specification.

m. Clause 1.48 Miscellaneous account

Unit: Prime Cost Sum

:Plus % for Contractor's overheads and profits

The Contractor, on provision of receipts, will be reimbursed on a prime cost basis for miscellaneous accounts plus a percentage for overhead and profits. This percentage shall be deemed to include for all costs in proving the items in the miscellaneous account including purchase, transport to site and complying with the requirements of clause 1.48 of this specification.

n. Payment of overtime for the Engineer's junior staff

Unit: Prime Cost Sum

:Plus % for Contractor's overheads and profits

Reimbursement for the payments of the Engineer's junior staff overtime shall be on a prime cost basis plus a percentage for overhands and profits. This percentage shall be deemed to include for all costs of complying with clause 1.49 of this specification.

2. MATERIALS AND TESTING OF MATERIAL

2.1 Information from Exploratory Borings and Test Pits

2.1.1 Factual Materials Report

The Factual Materials Report for this Contract does not form part of the Contract Documents. However, the Report will be made available for the **Contractor's information only**, and any conclusions on issues such as suitability of materials, location of borrow pits, material quantities etc., made by the Contractor on basis of the Factual Materials Report, will be at his own risk and at no extra cost to employer.

2.1.2 Trial Sections

The Contractor shall allow in his programme for constructing trial sections and carrying out tests upon them as directed by the Engineer. Trials would normally be required at the start of each structure and if changes of materials, method or equipment deem it necessary as directed by the Engineer. The time for completion of the Contract shall not be extended because of the time needed to construct trial sections and evaluate the tests on them.

No variation in the construction procedure, mix proportions, size, grading or source of any of the constituents shall be made without the agreement of the Engineer.

Trial sections, if found satisfactory, will be paid for under the rates in the Bill of Quantities for the appropriate items, as if the trial sections were part of the normal work. No separate payment will be made for trial sections and testing.

The Contractor shall make good, at his own expense; any trial sections that fail to meet the specified standards. The standards shall include, but not be limited to, material quality, layer thickness, levels and compaction.

2.2 Quality of Materials and Workmanship

The materials and workmanship shall be of the best of their respective kinds and shall be to the approval of the Engineer. In reading of these Specifications, the words “to the approval of the Engineer” shall be deemed to be included in the description of all materials incorporated in the Works, whether manufactured or natural, and in the description of all operations for the due execution of the Works.

All works or parts thereof shall be in accordance with the latest edition of either Kenya Bureau of Standards (K.E.B.S.) Specifications, or International Standards Organization (I.S.O.) Specification or British Standard (B.S.) Specifications and British Codes of Practice (C.P.) as published by British Standards Institution.

All materials shall be of approved manufacturer and origin and the best quality of their respective kind, equal to sample and delivered on to the Site a sufficient period before they are required to be used in the Works to enable the Engineer to take such samples as he may require for testing or approval, and the Contractor shall furnish any information required by the Engineer as to the quality, weight, strength, description, etc. of the materials. No materials of any description shall be used without prior approval by the Engineer and any condemned as unfit for use in the Works shall be removed immediately from the Site by, and without recompense to, the Contractor.

2.3 Trade Names

Trade Names and Catalogue References are given solely as the guide to the quality and alternative manufacturers of the materials or goods of equivalent quality will be accepted at the discretion of the Engineer.

2.4 Samples

Samples of all materials shall be deposited with the Engineer and approved prior to ordering or delivery to site. The Engineer reserves his right to test any sample to destruction and retain samples until the end of the maintenance period. No payment will be made for samples and the Contractor must in the rates of prices allow for costs of samples. All materials delivered to site shall be equal or better in all respects than 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 not to be valid under the Contract.

Any material delivered to the site or intended for the works not equal or better than the samples approved by the Engineer shall be removed and replaced at the Contractor's expense.

2.5 Testing

As provided in Clause 7 of the Conditions of Contract and in accordance with the Specification quoted for any material used on works of this Contract, tests may be called upon by the Engineer to be carried out at the place of manufacture or on the site. The Contractor may assume that the tests will be required on soils, workmanship, and materials whether natural or manufactured to verify their compliance with the specifications. Samples of all such materials and manufactured articles together with all necessary labour, materials, plant and apparatus for sampling and for carrying out of the tests shall be supplied by the Contractor at his own expense.

2.6 Testing at an independent laboratory

A prime cost item has been included in Bills of Quantities for testing of materials and workmanship as directed by the Engineer at an Independent Laboratory. The Contractor will be reimbursed receipted cost of testing carried out by the laboratory if the workmanship or materials pass the tests. However, if the result of tests shows that material is defective then the Contractor will bear the cost of testing.

2.7 Standards

Summary of British Standards Applied in the Final Design and Specifications are as follows. It should be noted that the latest version of each of the following standards are the applicable version under this contract.

BS 4	Part 1:	1972	Hot-rolled sections
Part 2:		1969	Hot-rolled hollow sections
BS 12: Part 1		1958	Portland cement (Imperial units)
Part 2		1971	Portland cement (Metric Units)
BS 21:		1973	Pipe threads for tubes and fittings where pressure-tight joints are made on the threads

BS 143:	1968	Malleable cast iron and cast copper alloy screwed pipe fittings for stream, air, water, gas and oil.
BS 416:	1973	Cast iron spigot and socket soil, waste and ventilating pipes (sand cast and spun) and fittings
BS 437:		Cast iron spigot and socket drain pipes and fittings
BS 437: Part 1:	1970	Pipes, bends, branches and access fittings.
BS 449:		The use of structural steel in building.
BS 449: Part 1:	1970	Imperial units
BS 449: Supplement No. 1(P.D. 4064) to BS 449: Part 1:	1970	The use of cold formed steel sections in building. Addendum No. 1 (1975) to BS The use of cold formed steel sections in building
BS 459:		Doors
BS 459: Part 2:	1962	Flush doors
BS 459: Part 4:	1965	Matchboarded doors
BS 534:	1966	Steel pipes, fittings and specials for water, gas and sewage.
BS 556:		Concrete cylindrical pipes and fittings including manholes, inspection chambers and street gullies.
BS 556: Part 2:	1972	Metric units.
BS 639:	1976	Covered electrodes for the manual metal-arc welding of carbon and carbon manganese steels.
BS 743:	1970	Material for damp proof courses. Metric units.
BS 747: Part 2:	1970	Roofing felts. Metric units.
BS 864: Part 2:	1971	Capillary and compression tube fittings of copper and copper alloy. Metric units
BS 882:	1992	Aggregates from natural sources for concrete (including granolithic)
BS 882: Part 1:	1965	Imperial units
BS 882: Part 2	1973	Metric units
BS 890:	1972	Building lines
BS 952:	1964	Classification of glass for glazing and terminology for work on glass.
BS 1010:		Draw-off tops and stopvalves for water services (screwdown pattern)
BS 1010: Part 1:	1959	Imperial units
BS 1010: Part 2:	1973	Draw-off taps and above-ground stop valves M
BS 1030:	1943	Schedule of cast iron drain fittings, spigot and socket type, for use with drain pipes to BS 437.
BS 1142:		Fibre building boards
BS 1142: Part 3	1972	Insulating boards (soft boards)

BS 1184:	1976	Copper and copper alloy traps.
BS 1186:	1975	Quality of timber and workmanship in joinery
BS 1186: Part 1	1967	Quality of timber
BS 1186: Part 2:	1971	Quality of workmanship
BS 1212:		Ball valves (excluding floats)
BS 1212: Part 1:	1971	Piston type
BS 1212: Part 2		Diaphragm type (brass body):
BS 1256	1953	See BS 143
BS 1377	1970	Methods of test for Soil for Civil Engineering purposes
BS 1387		Steel tube and tubular suitable for screwing to BS 21 pipe threads
BS 1722:	1975	Fence
BS 1722: Part 1	1972	Chain link fences Supplement No. 1 (1974) to BS 1772 part 1 fences, gates abd gate posts used in conjuction with chain link fences
BS 1881:		Methods of testing concrete
BS 1881: Part 1:	1970	Methods of sampling fresh concrete
BS 1881: Part 2:	1970	Methods of testing fresh concrete
BS 1881: Part 3:	1970	Methods of making and curing test specimen.
BS 1881: Part 4:	1970	Methods of testing concrete for strength.
BS 1881: Part 5:	1970	Methods of testing hardened concrete for other than strength
BS 1881: Part 6	1971	Analysis of hardened concrete
BS 2028:	1968	Precast concrete blocks
BS 2494:	1976	Materials for elastromeric joint rings for pipeworks and pipelines
BS 2871:		Copper and copper alloys, Tubes.
BS 2871: Part 1:	1971	Copper tubes for water, gas and Sanitation
BS 2871: Part 1:	1972	Tubes for general purposes
BS 2871: Part 3:	1972	Tubes for heat exchangers.
BS 3148:	1959	Test for water for making concrete
BS 3248:	1967	Polythene pipe (Type 50) for cold water services
BS 3416:	1975	Black bitumen coating solution for cold application
BS 3505:	1968	Unplasticised PVC pipe for cold water services
BS 3601:	1974	Steel pipes and tubes for pressure purposes: carbon steel with specified room temperature properties.
BS 4133:	1967	Flanged steel parallel slide valves for general purposes
BS 4164:	1967	Coal tar-based hot applied coaling materials for protecting iron and steel, including suitable primers where required.
BS 4190:	1967	Isometric black hexagon bolts, screws and nuts
BS 4254:	1967	Two-part polysuphide-based sealants for the building industry.

BS 4320:	1968	Metal washers for general engineering purposes
BS 4360:	1972	Weldable structural steels.
BS 4449:	1969	Hot rolled steel bars for the reinforcement of concrete.
BS 4461:	1969	Cold worked steel bars for the Reinforcement of concrete.
BS 4466:	1969	Bending dimensions and scheduling of bars for the reinforcement of concrete
BS 4483:	1969	Steel fabric for the reinforcement of Concrete.
BS 4505:		Flanges and bolting for pipes, valves and fittings. Metric series.
BS 4505: Part 1:	1969	Ferrous.
BS 4772:	1971	Ductile iron pipes and fittings.
BS 4848:		Hot-rolled structural steel sections.
BS 4848: Part 2:	1975	Hollow sections
BS 4848 Part 4:	1972	Equal and unequal angles
BS 5135:	1974	Metal-arc welding of carbon and carbon manganese steels
BS 5151:		Cast iron gate valves for general Purposes
BS 5153:	1974	Cast iron check valves for general purposes
BS 5155:		Cast iron and carbon steel butterfly valves for general purposes
BS 5163:	1974	Double flanged cast iron wedge gat valves for waterworks purposes
BS 8007:	1987	Code of practice for the structural use of concrete for retaining aqueous liquids (formerly BS 5337)
BS 8110:	1985	The structural use of concrete.
BS 5328:	1985	Method of specifying concrete including ready mix concrete
EN 12201-1	2002	Plastics piping systems for sewerage under pressure - water supply, and for drainage andPolyethylene (PE) - Part1: General
EN 2201-2	2011	Plastics piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) - Part 2: Pipes
EN 12201-3	2011	Plastics piping systems for water supply, and for drainage and sewerage under pressure – Polyethylene (PE) - Part 3: Fittings
EN 12201-5	2011	Plastics piping systems for water supply, and for drainage and sewerage under pressure polyethylene (PE)
BS 5268:		The structural use of timber
CP 112: Part 3:	1973	Trussed rafters for roofs of dwellings.
CP 231:	1966	Painting of buildings
CP 301:	1971	Building drainage
CP 308:	1974	Drainage of roofs and paved areas
CP 310:	1965	Water supply
CP 2010:	1971	Pipelines
CP 2010: Part 1:		Installation of pipelines in land
CP 2010: Part 2:	1970	Design and construction of steel pipeline in land
CP 2010: Part 3:	1972	Design and construction of iron pipeline in land

2.8 Measurement and payment

Except where payment items are provided for certain materials and required tests, no separate measurement and payment shall be made for materials and tests and the cost thereof shall be included in the appropriate tendered rates.

3. SITE CLEARANCE AND TOP SOIL STRIPPING

3.1 Site Clearance and Grubbing

Site clearance shall generally be restricted to the areas under permanent works without any provision for working allowance and/or as instructed by the Engineer. No separate measurement and payment will be made for site clearance of areas cleared by the Contractor for the Storage of Construction materials, camps, housing, workshops, stores, quarries, temporary works, and working space. The contractor's rates and prices are deemed to include for this work.

Clearing shall involve the following:

- The removal of all trees and bushes (complete with roots), other vegetation, rubbish and all other material that may interfere with the construction of the Works.
- The removal of all rocks and boulders of up to 0.15 m^3 in size, which are lying on the surface to be cleared or which are exposed during the clearing operations.
- The disposal of all material produced by the clearing.
- The removal and disposal of structures which encroach upon or may otherwise obstruct other work on the Site and which can be cleared by means of a bulldozer with a mass of approximately 20 t and a flywheel power of approximately 130 kW. (Structures that cannot be so cleared shall be dealt with as directed by the Engineer.)

Unless instructed, the site clearing for trenches shall only be for the width allowed for trench excavation.

The moving of a certain amount of soil or gravel may be inherent in or unavoidable during the clearing process. No extra payment will be made for the removal of such soil or gravel.

Areas that are cleared in strips for the purpose of constructing fences shall be cleared over the full length of the fence to a width as specified in the drawing and as instructed by the Engineer. Surface irregularities shall, in the case of fencing, be so graded that the fence will follow the general ground contour.

All stumps and roots exceeding 75 mm in diameter shall be removed to a depth of at least 100 mm below the original ground level. Where a construction bed or any other area has to be compacted, all stumps and roots including matted roots shall be removed to a depth of at least 200 mm below the cleared surface.

All material produced by the grubbing shall be disposed of.

Except in borrow areas, cavities caused by grubbing shall be backfilled with approved material and compacted to a density equal to at least that of the surrounding ground.

3.2 Cutting Trees

a. Protection of persons, animals and structures

The Contractor shall take the necessary precautions to prevent injury to persons and animals and damage to structures and other private and public property.

Where necessary, trees shall be cut in sections from the top downwards.

b. Branches overhanging boundaries

The branches of trees to be left standing shall be so trimmed as not to encroach upon the space (to a height of at least 7 m) vertically above any carriageway, railway formation, or other designated area.

c. *Preservation of trees*

No tree shall be cut down and no branches shall be trimmed off any of the trees to be preserved until the Engineer has given written authorization for such work to commence. Individual trees indicated and marked by the Engineer as trees to be preserved shall be left standing and undamaged.

3.3 The Disposal Of Material

Any material obtained from clearing and grubbing, the demolition of structures, the re-clearing of vegetation and the cutting of trees shall be disposed off in borrow pits or other suitable places indicated by the Engineer. Where no such place for the disposal of material is indicated by the Engineer, the Contractor shall make his own arrangements to provide a suitable place which complies with the requirements laid down by the Engineer. The disposal or burning if specially permitted of combustible material on the Site may be done only with the prior written approval of the Engineer. Care shall be taken to observe the air pollution under EMCA 1999.

All tree trunks and major branches shall be sawn into transportable lengths before removal from the Site.

No haulage will be payable to the Contractor for the disposal of material obtained from clearing and grubbing, the demolition of structures, the re-clearing of vegetation, and from the cutting of trees.

Materials from stripping such as suitable topsoil shall, if instructed by the Engineer, be stacked in approved areas. All other non-combustible materials shall be buried in approved disposal area; covered with a minimum of 0.5m of excavation spoil. These disposal areas shall be left with neatly graded surfaces and stable slopes that assure drainage. Alternatively the non-combustible material shall be removed from the area by the Contractor.

3.4 Removal of Topsoil

Topsoil shall be removed to spoil or stockpile where and as directed by the engineer. Spoil material shall be deposited in compliance with the relevant national and local laws and regulations. Measurement shall be the net area in square metres removed as directed and shall allow for stripping topsoil to a depth of 200mm. Should the Engineer instruct that a greater depth than 200mm be removed, payment for the additional material shall be made under the item for excavation in the Bills of Quantities.

The topsoil shall be removed from over the full width of the trench to a depth of 200 mm or if rock occurs closer than 200 mm to the existing natural surface. On completion of backfilling, the topsoil shall be replaced in its original position.

Should the Contractor strip to depths greater than those instructed by the Engineer, then the Contractor shall replace the material with suitable fill material at his own expense.

3.5 Measurement and payments

a. Clause 3.1. Site Clearing and grubbing

Unit: Areas square metre (m^2)

The unit of measurement for clearing and grubbing is the square metre or metre.

Only those areas or strips designated by the Engineer under clause 3.1 of this specification shall be cleared and grubbed in accordance with the requirements of Clause 3.1 and Clause 3.3 of this specification shall be measured for payments.

The tendered rates shall include full compensation for clearing the surface, removing boulders with a size of up to 0.15 m^3, cutting trees with single or multiple trunks each with a girth of 0.5 m or less, grubbing the stumps and roots of such trees, cutting trunks and branches into transportable lengths, backfilling cavities, demolishing structures, and removing, transporting and disposing of material thus cleared, grubbed, cut and demolished. Boulders exceeding 0.15 m^3 in size shall be dealt with as set out in Earthworks Section of this Specification.

b. Clause 3.2 Cutting and removing large trees with a girths exceeding 0.5m

Unit: Exceeding 0.5m and up to and including 2m number (No)

Exceeding 2m and up to and including 3m number (No)

The unit of measurement shall be the number of tree trunks cut and removed in each size group. The girth of a tree trunk will be measured at the narrowest point of the trunk in the first metre of its height above ground level.

The tendered rates shall include full compensation for cutting the trees and grubbing the stumps, for cutting the trunks and branches into transportable lengths, and for removing, transporting and disposing of all such trees, stumps, trunks, branches and associated material.

c. Grubbing and the removal of the stumps and roots of large trees with a girth exceeding 0.5m

Unit: Exceeding 0.5m and up to and including 2m number (No)

Exceeding 2m and up to and including 3m number (No)

The unit of measurement shall be the number of tree stumps and associated roots of which were grubbed and removed in each size group.

The tendered rates shall include full compensation for grubbing the stumps and roots, backfilling holes, cutting the stumps and roots into transportable pieces, and removing, transporting and disposing of all such stumps and roots and associated material.

The girth of a tree trunk will be measured at the narrowest point of the trunk in the first metre of its height above ground level.

d. Clause 3.4 Removal of top soil

Unit m^2

Removal of top soil shall be measured by the square meters calculated as the plan area measured from cross-section taken in accordance with clause 1.26 of this specification.

The rate for removal of top soil shall include for the cost of all hauls as necessary and compliance with the requirements of clause 3.3 and clause 3.4 of this specification

4. EARTHWORKS

4.1 General

Excavation shall be made to such lengths, depths and inclinations as may be necessary for the construction of the works or as shown on the drawings or as the Engineer may direct.

4.2 Definitions of Materials

For the purpose of these Specifications materials of earthworks are classified as follows:

(a) Hard material: Material which can be excavated only after blasting with explosives, or barring and wedging or boulders of more than $0.5m^3$ occurring in soft material shall be classified as hard material.
or
Rock is defined as solid masses, layers. or ledges of such hardness that it cannot be effectively loosened or broken by ripping with a track type tractor minimum flywheel power 250KW (335 HP) equipped with a single shank ripper and operating in low gear.

(b) Soft Material: All earth materials, which do not meet the requirements of hard material as defined in above.

(c) Overburden means soil as defined here above

Where it is impractical to proove hard material by the above method, then the quantity of hard material, if any, shall be determined by the engineer.

4.3 Scope

All the excavations covered in this section are open cut excavation also termed surface excavation in this contract:

- Excavation for cuttings (soil and rock).
  This covers mainly excavations under the embankment dam (not including the core trench excavation itself), excavation for cofferdam. excavation for the spillway.
- Core trench excavation (soil and rock)
  This covers the excavation of the trench for the embankment dam core with its adjacent filter and transition,
- Excavation for culvert (soil and rock)
  This covers the excavation of the trench for the culvert, the intake tower and the downstream valve chamber.
- Small size excavation (soil and rock) See BoQ for definition
- Excavation of earth fill material in borrow area
- Excavation of overburden in rock quarry This covers the excavation of the soil cover in the quarry
- Excavation of rock fills R1, R2 (and R5 in the alternative).

4.4 Excavation

4.4.1 General

The excavations (except in the quarry and borrow area) shall be made to the lines, grades and dimensions shown on the drawings.

The Contractor shall take all necessary measures to ensure the stability and safety of excavations,

Excavations needed by the Contractor installations shall be submitted to the approval of the Engineer,

All open out excavation shall be performed in accordance with this section to the lines, grades and dimensions shown on the drawings or as directed by the Engineer.

All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavation in the soundest possible condition.

Where, in the opinion of then Engineer, the surface of the excavation has become soft or unsuitable due the Contractor's method of working, the Contractor shall at his own expense remove and replace the unsuitable material with class 15 concrete or other approved material as instructed by the Engineer.

Any and all excess excavation for the convenience of the Contractor for any purpose or reason, except as may be ordered in writing by the Engineer and whether or not due to the fault of the Contractor, shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over-excavation shall be filled with compacted concrete class 15 or as directed by the engineer, furnished and placed at the expense of and by the Contractor.

All excavations shall be kept clean and free from water, and the Contractor shall dig diversion channels, erect coffer dams or otherwise dewater the excavations

If excavations are carried out in roads, footpaths, separators, or within 5m of buildings the Contractor is required to execute the work in a way that will minimize damage and disturbances.

All open excavations shall be clearly marked or covered by the Contractor to protect the public from any damage or injury. All costs arising from injury or damage to property or persons due to the Contractor's failure to protect open excavations and shall be borne fully by the Contractor.

The Engineer's approval to the final excavated surface shall be obtained prior to the laying of pipelines or construction of structures.

The sides of pits, trenches and other excavations shall, where required, be adequately timbered and supported, and all such excavations shall be sufficient size to enable the pipe and the concrete to be laid accurately and proper refilling and compaction to be carried out.

Where instructed by the engineer, shoring and supporting timber shall be left in trenches or other excavations.

Where ground conditions are such that a satisfactory foundation cannot be achieved the Contractor shall, if instructed by the Engineer remove the unsuitable material either until a suitable material is encountered or to the depth and width instructed by the Engineer. The Contractor shall backfill the resultant excavation with approved material to the satisfaction of the Engineer. Approved material may include rock fill and/or selected backfill material as directed by the Engineer.

The Engineer reserves his right to direct the Contractor as to the lengths of trenches or parts of bulk excavations which shall be opened up at any one time.

Where trenching, pipe-laying operations and culvert construction are carried out in built-up areas, the work shall be completed as quickly as possible so as not to unduly inconvenience the public. In the case of excavations in roads, and in other places which in the opinion of the Engineer are likely to cause interference to the public, then the works shall be completed as quickly as possible so as not to unduly inconvenience the public

No permanent work shall commence until the Engineer has inspected and approved the excavation.

The Contractor shall carefully set aside the various suitable materials encountered so that they may be reused for backfilling. If the excavated materials are unsuitable the Contractor may spoil the material only after approval by the Engineer. No extra claim will be allowed for setting aside surface material or topsoil for reuse or spoil.

4.5 Ground Levels And Reconstruction Cross Sections

Before the commencement of any earthworks the sites shall be surveyed in conjunction with the Engineers Representative to establish existing ground levels and these agreed ground levels shall form the basis for the calculation of quantities of any subsequent excavation and filling.

4.6 4.1.6 Topographical And Geological Survey After Excavation

A topographical survey of the excavated areas (except earthfill borrow area) shall be carried out by the Contractor at his owns expense under the control of the Engineer. On the topographical map obtained the Contractor shall draw any geological accident, fault, and seams with all their details.

These indications shall be reported under the control of the Engineers geologist.

In order to facilitate the inspection of the excavation surfaces, the Engineer Is entitled to request that these surfaces shall be cleared, washed and dried in order to enable a geologist to carry out a geological survey in the best conditions. In any case the earth filling or concreting of the excavation will not be carried out before they above been inspected and approved by the Engineer.

After his inspection the Engineer is entitled to request a deeper excavation, The earth filling or concreting shall not be carried out before another inspection has been done and the excavation approved.

4.7 Tolerances

For the excavations to be covered by concrete, or core material and adjacent filter and transition the tolerances shall be as follows: -

- for the $\pm$lOOmm
- for the horizontal dimensions $\pm$1m

4.8 Disposal Of Excavated Material

In so far as they may be suitable and comply with the Specification, materials arising from excavations may be used in the Works. All surplus or unsuitable excavated materials shall be disposed to spoil banks at locations shown on the drawings or accepted by the Engineer.

4.9 Spoil Banks

All necessary measures shall be taken not to obstruct natural drainage courses with the s1oil banks

Spoil banks shall be graded to a neat appearance with outer slopes not exceeding 3H/lV.

Suitable slopes shall be given to the surface to ensure drainage.

The maximum allowable height of the spoil banks shall be fixed by the Engineer.

4.10 Use Of Explosives

• Permission to blastBlasting shall only be carried out on those sections of the works for which permission in writing shall above been given by the Engineer. If blasting is necessary adjacent to any structure the Contractor shall provide a seismography and demonstrate that:

- For concrete or grout in place more than four hours but less than 60 hours, the maximum particle velocity as determined by seismographic measurement shall not exceed 10 mm/s.
- For concrete or grout in place less than four hours and greater than 60 hours, the maximum particle velocity shall not exceed 60 mm/s, except that for structures with a top width greater than their height and consisting of mass concrete or concrete having only nominal reinforcing. maximum permissible particle velocity may be increased to 80 mm/s with approval of Engineer.

On basis of measurements obtained and on basis of observation made of structures after each blast, limits specified herein may be revised by Engineer.

4.10.1 Compliance with laws and regulations

The Contractor shall at all times take every possible precaution and comply with the Explosives Laws of Kenya and regulations relating to the handling. Transportation, storage and use of explosives and shall at all times when engaged in blasting operations sufficient warning flagmen to the full satisfaction of the Engineer.

The Contractor shall at all times make liaison with and inform well in advance and obtain such supervision and permission as is required from the Police and all Government Authorities, public bodies and private parties whosoever concerned or affected by blasting operations.

The Contractor shall provide a special store for explosives in accordance with Kenyan Regulations. The Contractor shall provided experienced men with valid Kenyan blasting licenses for handling explosives to the satisfaction of the Engineer and the Authorities concerned.

4.10.2 Submittals

The Contractor shall submit to the Engineer for his approval in advance details of the intended drilling patterns, depths of holes, the amounts of explosives at each location and the method or sequence of firing that the proposes to use.

4.11 Pre-Splitting

4.11.1 General

Pre-splitting comprises drilling a line of holes of appropriate diameter, spaced on centres not fore than 10 times the diameter of the drill holes diameter or 30cm whichever is the greater and charging the holes with the appropriate amount of explosives to shear the rock in a surface along the line of drill holes. Either all holes in a pre-splitting row shall be drilled, charged and detonated simultaneously prior to drilling the production holes for the excavation adjacent to the pre-split row or pre-splitting shall be accomplished by delaying the production holes to allow the presplit holes to fire first. It is to be expected that the first row of production holes adjacent to the presplit face will need to be lightly charged to ensure that no damage occurs to the pre-sheared face when the main charge is detonated.

4.11.2 Submittals

The Contractor shall submit to the Engineer for his approval the proposed detailed methodology for presplitting.

4.12 Excavations In Quarry

4.12.1 General

Excavation of the overburden in quarry

The extent of the overburden shall be defined by the Engineer after the site investigation at the beginning of construction. Excavated material shall be sent to soil bank, or if suitable and complying with the specifications can be reused as fill.

4.12.2 Submittals

The planning of exploitation for quarry and method statement shall be submitted to the Engineer one month before starting excavations in the quarry.

4.13 Change In Quarry

When exploiting quarry the Contractor shall perform all necessary investigations to document the quantity and quality of rock which remains to be exploited and shall inform the Engineer in writing. In case of insufficient quantities use of alternative quarry shall be contemplated.

4.14 Excavation Of Earth Fill Material In Borrow Area

4.14.1 Investigations

Before opening excavations in the borrow area for earthfill, the Contractor shall perform a detailed investigation which shall include 1 exploratory pit per 10,000 m2 of borrow area. Depth of the pit shall be about 8m. Samples shall be taken every 1.5 m and subjected to the following laboratory tests in the contractor’s laboratory:

- natural moisture content
- Atterberg limits
- grading and hydrometer
- standard compaction test

The pits shall be logged as instructed by the Engineer and results shall be submitted to the Engineer.

4.14.2 Submittals

The earthfill borrow area planned exploitation shall be submitted to the Engineer one month before starting excavations in the borrow area.

4.14.3 Miscellaneous

- No borrow area shall be opened at less than 300 m from the upstream dam toe.
- The maximum slope of excavations in the borrow area located within the reservoir shall be 2.5 H to 1 V.

4.15 Preparation of Foundations and Treatment

4.15.1 Works Included

- Preparation of foundation for embankment dam shells
- Preparation of foundation for core and filters (phase I and 2)
- Slush grouting and dental concrete
- Preparation of foundation for concrete structures (phase 1 and 2)
- Preparation of foundation on soils.

4.15.2 Preparation of Foundation for Embankment Dam Shell

In principle dam shell foundation, after having excavated red clays from the left bank, red clays and alluvium in the river bed and completely decomposed pumice tuff on the right bank shall be mainly very soft to soft rock. Locally on left bank a trachyte spur should be encountered. After excavation of the overburden, the soft rock or hard rock foundation shall be mechanically cleaned of loose material using if necessary in case of rock irregular surface backhoes or small size bucket.

4.15.3 Preparation of Foundation for Core and Filter

This preparation shall be carried out in two phases:

First phase

After the excavation of the core and filter trench, the foundation surface shall be cleaned of all loose or otherwise unsuitable materials by hand and compressed air.

At it is considered that the pumice tuff and agglomerates are likely to deteriorate and fissure under drying/wetting cycles a cover of 2 mm of unexcavated materials shall be left on these rocks with respect to final excavation depth.

The grouting operations shall be performed from this surface. If necessary, and in case the trachyte spur would present overhangs, dental concrete would be used to correct these overhangs as directed by Engineer so as to end up with slopes not steeper than 1 to 1 in any direction.

Second phase

After having performed the grouting operation, and just before placing fill above the soft rock, the final excavation with hand tools of the remaining 20 cm (jack hammers if necessary) shall be performed. The rock surface shall be cleaned with compressed air and brushes. The exposed surface shall be sealed with slush grout as directed by the Engineer.

Slush grout shall be a mix of one part cement to 3 parts of fine sand with 200mm slump. Slush grout shall be broomed into cracks In the rock. The slush grout shall be kept damp until covered by earthfill. No fill shall be placed in any section of the embankment until the foundation has been inspected and approved by the Engineer.

4.15.4 Control of Water in Foundation for Core and Filters

- A spring encountered in prepared foundation be reported to the Engineer.
- No placement of compacted fill for core, filters or transition shall be performed in water.
- In case of springs or other water ingress, the Contractor shall pump into sumps protected with pipes such as to obtain a dry excavation bottom. After having constructed the first metres of backfill, the sumps and their protection pipes shall the carefully grouted.

4.15.5 Preparation of Foundation for Concrete Structures

- In principle the intake, tower, the culvert, the downstream valve chamber and the whole spillway shall be mainly founded on soft rock (pumice tuff).
- As for the core and filter of the embankment dam, the foundation preparation shall be carried out In two phases.

First phase

The rock loosened by blasting (or ripper if ripping appear possible) shall be prepared with jackhammer or any other way to obtain the best possible surface state.

Then the rock surface shall be cleaned of all loose or otherwise unsuitable materials by hand and compressed air.

As it is considered that the pumice tuff and agglomerates are likely to deteriorate and develop crack under drying wetting cycles a cover of 2 mm of unexcavated materials shall be left on these rocks with respect to final excavation depth.

In the spillweir area, the ham grout curtain shall be constructed after this stage.

Second phase

Just before performing concreting, the remaining rock cover shall be excavated with jack hammers and hand picks. Cracks and fractures shall be cleaned and grout spillage chipped out. Finally the surface shall be cleaned with compressed air jets and brushes. If necessary, cavities shall be filled with dental concrete and slush grout shall be used locally as directed by the Engineer.

The concreting operation shall immediately follow.

4.15.6 Preparation of Embankment Foundations on Soils

After stripping and (or) excavation, foundations other than soft rock shall be scarified, moistened if necessary and re-compacted to 95% of the standard proctor maximum density before proceeding with backfilling.

Pockets in the foundation from which unsuitable materials above been removed shall be backfilled with approved compacted material.

Filling

Works Included

- Compacted fill RC for dam core
- Compacted fill
- Dumped red clay
- Compacted rockfill type R1
- Compacted rockfill type R2
- Compacted rockfill type R5 (alternative)
- Filters Fl and F2 and Transition T1
- Riprap R3 and R4

4.16 Embankment dam

a. The embankment dam shall comprise compacted fill for dam core, filters, transition, rockfills and riprap.
b. The embankment shall be constructed to the lines and dimensions shown on the drawings
c. The embankment core, filters and shells shall be constructed in sub-horizontal layers across the full width of the valley, but a maximum 3m height difference between the core and the cc of the rockfill shells shall be tolerated in rainy periods slowing core construction,
d. To ensure surface drainage, the embankment layers shall be constructed with a 4% slope. During the rainy period and before construction shutdowns, the core surface layer shall be closed with a smooth drum roller to avoid water ponding at the surface. The same instructions shall be followed for the rockfill if due to fines the rockfill is not free draining.
e. During the dry periods and especially in case of slow construction pace, the core shall be protected against drying by either Spreading 0.30 m loose core till material or controlled sprinkling.
f. Traffic and access tracks No traffic will be accepted on the dam core excepted the hauling Spreading and compacting equipment of the core material. Crossing over the core will not be accepted by the Engineer without special provisions. The same restrictions are made for the filter and drain materials, The Contractor shall serve all the access tracks which are outside the design line of the typical cross sections.

Similarly, the Contractor shall fill in accordance with the specifications the zones of the tracks which would be inside the design line of the typical cross sections and which would above been agreed by the Engineer.

4.16.1 Other compacted fills

Compacted fills (other than dam core) shall be used in cofferdams. as backfill behind spillway wails, downstream valve chamber, downstream part of the culvert, and embankments for roads.
Compacted fills shall be constructed in sub horizontal layers.

4.16.2 Trial embankments

At an early stage in the construction of the Works the Contractor shall construct trial embankments, using the plant and materials he proposes to use for the

permanent works. The trial embankments shall be constructed in a location to be agreed with the Engineer. The trial embankments shall be so sited as to allow a clear run of at least 40 m for the compaction equipment and shall contain not less than 10 m3 of compacted fill (except for filters).

The width shall be more than 3 times the width of the rollers.

The Contractor shall use the same equipment and techniques to construct the trial embankment as that which he proposes to use to construct the main embankment. In collaboration with the Engineer the Contractor shall determine on the trial embankment the loading of the rollers and the number of roller passes required to achieve the specified degree of compaction.

In demonstrating his working method the Contractor shall cover the following items:

4.16.3 Test embankment for dam core

- moisture reduction of fill material in the borrow area
- wetting of fill material in the borrow area
- Spreading, grading and layer thickness control
- compaction of fill (at least 3 layer thickness to be investigated with 2 different placement moisture content)
- performance of controls Test embankment for rockflll
- Spreading, grading and layer thickness control
- segregation control
- compaction (at least 2 lift thickness)
- moistening of the fill
- performance of controls Test embankment for filters
- Spreading and control of the width
- compaction

Before commencing the trial embankment the Contractor shall submit in writing his proposa for carrying on the trials for the approval of the Engineer. On completion of the trial embankment the Contractor shall submit a report on the trials to the Engineer.

No earthfill shall be placed as part of the permanent works until the trial embankment relevant to that section of work has been completed.

4.16.4 Tolerances

The tolerances of finished earthfill core, filters, rockfill and riprap with respect to the dimensions and lines shown on the drawings shall be as follows:

	Tolerance (mm)
Embankment rockfill slopes	+303, -0
Berm level	+100, —0
Crest road	+100, -0
Filter thickness	+100, -0
Core thickness	+200, -0
Riprap thickness	+200, —0

Payments shall be made only as per lines, grades and dimensions showing on the drawings without considering these tolerances.

4.16.5 Controls

All the controls required in the earthworks specification shall be performed In the Contractor's laboratory and by the Contractors staff under the direct supervision of the Engineer.

4.16.6 Submittals

At least one month before starting the filling operations, the Contractor shall submit a complete programme showing the proposed filling programme including quantities and origin of materials(excavations for cuttings -a borrow area — stockpiles if any, etc).

At least one month before starting the filling operations, the Contractor shall submit to the Engineer a detailed method statement covering the embankment construction with special emphasis on material placement.

On a weekly basis, the Contractor shall submit to the Engineer summary sheets giving the results of all controls performed during the week on a format to be agreed with the Engineer.

Before the commencement of any earthworks the site stall be surveyed in conjunction with the Engineers Representative to establish existing ground levels and these agreed ground levels shall form basis for the calculation of quantities of any subsequent filling.

4.17 Compacted fill for dam core

4.17.1 Material

The fill material for the dam core shall be approved 'red clays" from the borrow area or from the excavations.

The material shall comply with the grading shown below:

Compacted fill for RC dam core	
Material size in mm (square openings)	Percent filter than by weight
20	100
10	90-100
5	80-100
2	70-100
0.075	40-90
5 microns	
(Hydrometer)	25-75

The Atterberg limits shall be within the following values

- liquid limit : LL = 40 to 85%
- plasticity index : PI = 20 to 45%

The material shall be free of roots, pieces of wood or other organic matters and debris.

4.17.2 Spreading and compaction

After Spreading and before compaction the thickness of the loose lift shall be controlled such as to end up after compaction with the thickness determined from

the trial embankment for the selected compaction equipment and number of passes. Compaction of the core shall be performed with a tamping foot compactor operating at less than 4 km/h. The compactor shall be equipped with cleaning fingers.

The unit weight of the compactor per cm of drum equipped with the tamping foot shall be in the range 45 to 65 kg/cm. The lift thickness shall be adjusted to achieve the compaction requirement depending on the effectively proposed equipment.

Along concrete surfaces, and at all locations were easy access to the here above equipment is not possible. compaction will be performed with small size fuel engine mechanical tampers minimum weight 60 kg.

The quality of the finding between the different fill layers shall be checked by visual examination in short exploratory pits. In case of or lending a special preparation of the compacted lift before Spreading the new lift shall be required.

4.17.3 Compaction control

a. criteria

The compacted fill RC for dam core shall be compacted in such a manner that:

Placement moisture content

• for any test: $0 \leq (w\text{-}wopt < +3$

• for 80% of the test: $0 \leq (w\text{-}wopt < +2$ (examinated In batches of 25 results) with,

w : placement moisture content measured on the compacted layer

wopt : optimum moisture content of the standard compaction test

Dry density

$DC = \gamma_d/\gamma_{max} \geq 95\%$

with:

γ_d = field dry density

γ_{max} = standard Proctor maximum dry density

For dam core materials compacted immediately at the contact of the foundation or around the concrete culvert, the placement moisture content shall be

$$\pm 1 \leq w - wopt \leq +3$$

If the pore pressure monitoring (see instrumentation section) reveals excessive or insufficient pore pressures in the opinion of the Engineer, the moisture placement requirement shall be amended by the Engineer.

Any material which has been placed in the embankment and prepared for compaction at a moisture content outside the limits specified and any material being compacted, which has been damaged by drying or wetting or any other cause, shall be reported or re—worked to the satisfaction of the Engineer.

b. Method of control

In situ density after compaction shall be measured either by hammering site cutter samplers of known volume or by using membrane densitometers or by USER procedure E24. Around the in situ density test a 20kg soil bulk sample shall be taken and protected in a sealed bag to allow performance of the rapid compaction control method. Close to the in situ density test, two determinations of undrained shear strength with a field inspector vane shall be performed.

The compaction control shall be performed with the rapid compaction control method (11110 Designation 1125 USER Earth manual unified as follows:

Instead of 3 tests, 4 shall be performed allowing to construct morn easily the Hilf parabola. Moisture content measurements shall be performed on every Hilf test allowing to plot after 24 hours, a classical proctor curve, A constant record of the compaction degree and w—wopt figures obtained with the two approaches shall be kept so as to check the coherence of the two methods.

For each point of the **Hilf** method 4 measurement of undrained shear strength Cu with a laboratory vane shall be performed so as to progressively create a data base giving the relationship log (Undrained shear strength) vs w-wopt which shall be used for a preliminary appraisal of the w—wopt value on the borrow area and on the dam. This method is no more than a guide and shall not be used as a contractual method of control. The contractual method of control shall be the 1125 USER described here hove with the proctor controls. During the first weeks of construction the Engineer shall recalculate the charts giving the correction factor in the Hilf method for the exact specific gravity of the fill and the saturation degree at optimum The charts shall then be used by the Contractor.

In addition to the F25 method for compaction control the following tests shall be performed:

Classical proctor test.

- Undrained shear strength on 100mm diameter undisturbed samples of fill (Unconsolidated undrained triaxial test).
- After having checked the validity of controls based on undrained shear strength measurement the Engineer may progressively substitute this type of control to the USBR E25 method.
- Measurements of undrained shear strength in the field using a Gêonor field inspector vane or equivalent.
- The location of controls shall be given in X.Y.Z coordinates or with respect to transverse profiles duly located on drawings.

c. Rate of controls in core

The normal rate of control shall be as shown in the following table:

Type of test	Nb of tests per m3 of fill
In situ density + amended USBR E25 undrained strength with vane test	1no. for 1000 m3 or minimum 1 per shift
Undrained shear strength on dia. 100mm sample (triaxial UU)	1no. for 2,000m3 or minimum 1 every two days
Classical Proctor test	1no. for 5,000m3

The frequency of the tests may be amended as required by the Engineer depending on the results of previous tests, material variation, or climatic conditions.

4.18 Other Compacted Fill

4.18.1 Material

The other compacted fill (cofferdams spillway chute, downstream valve chamber, downstream part of the culvert. etc) shall be approved "red clay" from the borrow area or from the excavation. It shall fulfill the grading and Atterberg limit requirements given in section 4.17.

4.18.2 Spreading and compaction

Same requirements as in section 4.17.2,

4.18.3 Compaction control

a. regulation control

Using the same symbols as in 4.17.3

Placement moisture content

$$-2 \leq W - W_{opt} \leq +2$$

Dry density

$$DC = \gamma_d/\gamma_{max} \geq 95\%$$

b. Method of control

In situ density + amended USBR E25 + undrained shear strength with vane test.

c. frequency of control

1no. control for 1,000m^3

4.19 Dumped Red Area

4.19.1 Material and grading

Dumped red clays shall be used as watertight element upstream the pre-cofferdam as shown in drawing 207.

The material shall be approved red clays from the borrow area or from the excavation. It shall fulfill the grading and Atterberg limits requirements given in section 4.2.3.1 but shall be dry with respect to optimum (lower part of the borrow areas) so as to contain chunks.

Placing

The selected material shall be pushed down with the blade of the bulldozer operating parallel to the pre-cofferdam slope.

4.20 Filters and Transitions

4.20.1 Geotextile material

The Geotextile fabric material is to be used in the construction of drainage blanket and vertical sloping filters and shall meet the following minimum characteristics:-

- Manufactured with polyster fibre,
- Non woven needle punched randomly oriented mat of continuously and stabled fibre compacted and mechanically entangled by multiple piercing with barbed needles fleece held together by entanglement,
- Weight not less than 0.3kg/m2,
- Fabric lapped not less than 15cm.

- Tensile strength (KN/M2) – 50
- Coefficient of permeability(m/s)- 0.4

4.20.2 Materials

Filters Fl, F2 and transition T1 shall consist of hard durable crushed rock or natural sand and gravels derived from sources approved by the Engineer.

The filters Fl-F2 and transition TI shall comply with the grading requirements shown on drawing 204 and quoted below. These gradings should remain fulfilled after handling, placing and compaction and shall be controlled on the stockpile and after compaction.

Material size in millimeters (square openings)	Percent finer than by weight	
	Filter Fl	Filter P2
50	l	100
20	100	90-100
10	—	60-100
5	95-100	15-60
2	70-100	0-5
1	40-80	-
0.5	15— 50	-
0.2	0—15	-
0.075	0- 3	-

Material size In millimetres (square openings)	Percent finer than by weight
	Transition T1
100	100
50	80—100
20	55-80
5	35—60
1	10-35
0.075	2- 15

In addition, the material shall meet the following test requirements:

- Los Angeles abrasion test not to exceed 45% by mass
- Water absorption not to exceed 7%

4.20.3 Placing and compaction

Transition and filters upstream and downstream the core shall be placed in approximately horizontal layers in the range 250-400mm compacted thickness depending on the finally selected lift thickness for the core.

Filters and transition placed on dam foundation shall be placed in layers not exceeding 250 mm compacted thickness.

Each layer (on the foundation or upstream/downstream the core) shall be compacted by means of a vibrating smooth drum roller so as to achieve a relative density in the range 70% - 80%. The relative density shall be determined by the USBR Method Designation El2.

If necessary to achieve the compaction requirement, filters shall be wetted.

For the filter box the relative density shall be larger than 80% and the material shall be wetted.

Care shall be taken not to pollute filters and transitions with earthfill. Any polluted filter or transition shall be replaced.

4.20.4 Controls

Final acceptance of filters and transition shall only be made after materials above have been dumped, spread and compacted.

4.21 Compacted Rockfill

4.21.1 Material

a. Basic solution

In the basic solution, two types of compacted rockfill are used in the embankment dam: Rockfill R1 and Rockfill R2. They shall consist of hard durable rock from quarry Q1 or other approved quarry or from the excavations in case suitable material would be encountered.

They shall be reasonably well graded within the limits shown on drawing 204 and quoted below.

Material size In millimetres	Percent finer than by weight

Square opening	Circular opening	Rockfill R1	Rockfill R2
600	750	100	100
200	250	70-100	100
300	125	-	100
100		50-90	50-90
50		30-75	35-75
20		10-50	10-50
10		0-35	0-35
5		0-25	0-25
2		0-15	0-15
1		0-10	0-10
0.075		0-5	0-5

In addition, the material shall meet the following test requirements:

- Los Angeles abrasion test not to exceed 55% by mass
- Unconfined compressive strength larger than 18MPa
- Specific gravity:
    - OD larger than 2.30
    - SSD larger than 2.40
    - APP larger than 2.65
- Water absorption not to exceed 7%.

b. Alternative

Rockfill R5 should be reasonably well graded within the limits shown on drawings and quoted below: -

Square opening	Circular opening	Rockfill R1
600	750	100
200	250	70-100
100	175	55-100
50		40-80
20		20-60
2		15-40
0.075 (hydrometer)		5-25

c. For rockfills R1, R2 and if necessary R5.

The Contractor shall perform all processing needed to obtain rockfills which meet specified requirements. Such processing shall, where necessary. include separating material with one another. there blending is required, materials shall be thoroughly mixed in such a manner that a homogeneous fill of specified gradation is achieved prior to placing of material into work or stockpiles.

Contractor's processing plant and methods will be subject to Engineer's approval, Processing plant shall be capable of producing rockfill at a rate satisfactory for meeting scheduling requirements. Processing shall be done in an area approved by Engineer.

The maximum lift thickness for rockfill! R1, R2 and R5 shall be 0.80 m. Placing shall be performed so as to obtain homogeneous fill without segregation. The rockfill shall be dumped on top of the new layer. back from the advancing edge and pushed over **on** the lower layer with bulldozer blades.

- Any other size particle which protrudes from the layers shall be removed before compaction.
- Moistening of the rockfills shall be performed to the extent necessary to achieve the best compaction as demonstrated in the test embankment.

Compaction

Compaction of rockfill shall be performed with an approved single or double smooth drum vibrating roller with the following characteristics:

- minimum static weight – 10t
- drum diameter – not less than 1500mm
- maximum drum length 2200 mm
- minimum static weight per m of drum 4.5
- minimum total applied compacting force at rated
- vibration frequency 30

Roller shall travel at speeds not to exceed 4 km/h.

The number of passes shall be in the range 4 to 6, the construction value being selected based on the trial embankment result.

Controls

Final acceptance of rockfills shall only be made after materials above been dumped, spread and compacted in place. Rejection by Engineer may be made at source. on transporting vehicle, or in place. Contractors shall co-operate with Engineer to ensure that only acceptable rockfill materials will be hauled from source to works.

In the alternative, in case rockfill R5 would, in the Engineer's opinion develop construction pore pressures, Horizontal strips of rockfill R1 (and paid as R1) would be laid as directed by the Engineer. In the alternative. In situ permeability test in rockfill R5 shall be performed.

4.22 RIPRAP R3 AND R4

4.22.1 Material

Riprap R3 (upstream slope protection of the dam) and R4 (spillway downstream protection) shall be obtained from rock quarry Q1 or other approved sources.

Grading shall be within the limits shown below:

Material size in millimetres		Percent finer than (by weight)	
Square opening	Circular opening	Rockfill R3	Rockfill R4
600	750	100	
500	625	70-100	100
400	500	40- 60	l00-0

300 200	375 250	0-20 0	0

In addition rock shall meet the following test requirements:

- Los Angeles abrasion test not to exceed 40% by mass
- Unconfined compression strength larger than 25 MPa
- Specific gravity
    - OD larger than 2.40
    - SSD larger than 2.50
    - APP larger than 2.70
- Water absorption smaller than 5%

4.22.2 Placing

Riprap need not be compacted but shall be placed carefully in such manner that larger rock fragments are uniformly distributed and small rock fragment fill voids between larger pieces. Hand placing will he required to extent necessary to secure results specified above. The specifications as to rock size and grading specified herein, shall apply to riprap in place. Riprap shall be placed simultaneously with embankment construction so that a minimal of breakdown will occur during placing and Spreading, and shall be placed in lifts not exceeding 1.5 m in width parallel to slope.

4.22.3 Controls

Final acceptance of riprap will only be made after materials above had been placed. Rejection by Engineer may be made at source, on transporting vehicle, or in place, Contractor shall cooperate with Engineer to ensure that only acceptable riprap materials will be hauled from source to work.

4.23 Roads

4.23.1 General

The Contractor shall construct and maintain the permanent roads comprising the embankment crest road, the access roads on the gravel surfacing on platforms and backfill as shown on the drawings. There permanent access roads are used by the Contractor for access during construction. The Contractor shall reinstate to the satisfaction of the Engineer gravel surfacing to the thickness grade and crossfall as shown on the drawings.

4.23.2 Subbase

The sub base material for access road shall be approved material compacted to 150 mm thickness at 95% of modified Proctor maximum density.

The sub base material shall comply with the following grading requirement:

- - 100% by weight passing 50 mm sieve (square mesh),
- - 75-85% by weight passing 20mm sieve (square mesh),
- - 40-50% by weight passing 5 mm sieve (square mesh).

Before placing the sub base, the foundation shall be scarified and recompacted.

4.23.3 Gravel Surfacing

The gravel surfacing for access roads, embankment crest road, backfill and platforms protection shall be 200 mm average thickness of approved gravel rolled to a smooth even surface.

The term "gravel" used shall be any such material which night be specified for use as a wearing course, e.g. murram, some forms of partly decomposed rock or crushed rock.

Gravel surfacing material shall be spread in a uniform layer across the full width required, spread so that the maximum size of any particle Is not greater than one half the compacted thickness of the layer. It shall then be mixed, watered if directed by the Engineer, graded and compacted by at least 6 complete passes of a 10 tonne smooth wheeled roller or other equivalent and graded to final level.

The tolerances on level permitted in the final surface of the wearing course will be:

	Variations permitted		Camber
	Thickness	3 m straight edge	
Gravel wearing Course	25 mm	25 mm	25 mm

4.24 Trench Excavations

4.24.1 Timbering of Excavations

The Contractor shall supply and fix outside the limits of the permanent Works all the timber necessary for support of sides and bottoms of the excavations, for the security of adjacent structures and properties and for every other purpose for which it may be required, all to the satisfaction of the Engineer. The Contractor shall maintain such supports until in the opinion of the Engineer, the works is sufficiently advanced to permit the withdrawal of the support. Such withdrawal shall be executed only under the personal supervision of a competent foreman.

The Engineer may order excavations to be timbered or to be close timbered or may order timbering to be driven ahead of the excavation, or may order the adoption of any other method of supporting the sides and bottoms of the excavations as may appear to be necessary, and the Contractor shall adopt and shall make no charge for executing the adopted method.

The Contractor shall be responsible for any injury to the workers and any consequential damage caused by or arising out of the insufficiency or the support he provides for his excavations or caused by or arising out of the removal of that support, and any advice, permission, approval or instruction given by the Engineer relative to that support or removal thereof shall not relieve the Contractor of his responsibility.

For the purpose of this Clause the words "timber" and "timbering" shall be construed to include trench sheeting and steel or concrete sheet piling or any other means adopted by the Contractor for supporting excavations. All the costs for

compliance with the provisions of this clause shall be deemed to have been included in the Contractor's rate for excavation

4.25 Excavation to be Kept Free from Water

Where excavations are required below the existing water level, the Contractor shall make arrangements to keep the excavation dry and shall produce drawings and written explanations of the method to be used to enable the Engineer to determine the adequacy of the method, before commencing the excavation.

The Contractor shall give due regard to the possibility of floods and provide all pumps, timbering, coffer dams, sheet piling and other equipment necessary for keeping the excavations free from water.

Every precaution shall be taken not to diminish the bearing capacity of the soil below foundation level. Wall-points or pump pits are to be outside the foundation area to prevent flows in upward direction.

All sumps and drains are to be filled in or otherwise made good as directed by the Engineer on completion of the relevant part of the Works.

The costs of all the above precautions shall be at the contractor's expense.

4.26 Excavation in Hard Material

Where hard material is encountered in trenches for pipe lines it shall be excavated so that no hard material protrudes within 100mm of the pipe surface. A regulating layer of 150mm sand or other approved material shall be placed on the excavated hard material surface to provide a firm but flexible bed for the pipe.

The Contractor shall notify the Engineer on each occasion when he encounters hard material prior to excavation of such materials. No payment for excavation in hard material shall be made unless the Engineer has inspected the excavation and certified in writing that the material meets the classification of hard material and the quantities involved.

The Contractor shall trim all rock faces in cutting to accord with the dimensions shown on the drawings and upon completion leave them safe from rock falls to the satisfaction of the Engineer.

The Contractor's blasting and other operations in excavation shall be such that they will yield as much suitable material as possible for the construction.

4.27 Foundation for Structures

4.27.1 Soft material:

The bottom and side slope of soft material upon or against which concrete is to be placed shall be finished accurately to the established lines and grades, and loose materials on surfaces so prepared shall be moistened with water and tamped or rolled with suitable tools and equipment to form a firm foundation for the concrete structure. If, at any point in Soft material, material is excavated beyond the established excavation lines, for any reason except by written orders from the Engineer, then the over-excavation resulting voids shall be filled with concrete class 15 at the Contractor's expense.

4.27.2 Hard Materials:

The bottom and side slopes of hard material upon or against which concrete is to be placed shall be excavated to the required dimensions as shown on the drawings or established by the Engineer. No material will be permitted to extend within the neat lines of the structure. If, at any point in the hard material, material is excavated beyond the limits required to receive the structure, the additional excavation shall be filled solidly with concrete class 15.

All loose material shall be removed by the use of steel brooms and air jets.

4.28 Trench Excavations

The width of the trench to be excavated will depend on the size and type of pipe being laid. Sufficient width must be excavated to allow the pipe to be correctly bedded and aligned, and to allow for the joints to be correctly made. Generally the grade of the pipe will conform to the lie of the ground, but the excavation must be deepened where necessary to avoid backfills in any section. Generally the pipeline will slope down towards scour valves and up towards air valves. Minimum gradients are shown on the general drawings.

Width of excavations for trenches for all pipes shall be determined from the following formula

$$W=nD + (n-1)0.3 + 0.6$$

Where:

W= width of the trench to be excavated

n =number of pipes

D = external diameter of the pipe

Trench excavation shall be carried out with great care, true to line and gradient and as near as practicable to the size required for construction of the permanent work.

Excavation for pipe trenches shall be of sufficient depth to give a minimum cover of 900 mm over the top of the pipe and 1.2 below the road crossings.

Where the pipeline is required to be laid at depth, which does not satisfy the minimum cover conditions set out above, the ground surface shall be brought up to the required level by banking the backfill or as directed by the Engineer.

4.28.1 Backfilling with Excavated Suitable Material

No backfilling or refilling shall commence without the Engineer’s approval.

The refilling of excavations shall commence as soon as practicable after the permanent works have been tested where so required and inspected and approved by the Engineer. In particular the backfilling of trenches shall be carried out expeditiously to reduce lengths of trenches open at any one time.

As soon asHigh Density Polythene pipes are laid and jointed in their final positions they should be protected from possible damage by carefully backfilling of fine granular material brought up to about 150 mm over the top of the pipe, for the full width of the trench, and well compacted.

Joints must be left open for inspection until the pressure test is completed.

Backfilling shall be executed with suitable excavated material in 150 mm layers each layer being well rammed and watered to obtain the maximum compaction. Care shall be taken to ensure that no stone or other material, which could damage pipes or other work.

Water in excess shall not be used in settling of the backfilling.

Backfilling over steel pipes shall be generally as described above, except that the initial protective filling around the pipe is not necessary.

Regardless of the means of backfilling adopted, it is the Contractor's responsibility to ensure that he satisfactorily backfills all excavations and causes no damage to permanent work or adjacent structures, and he shall at his own expense take all steps necessary to comply with this obligation.

The Contractor shall at all times be responsible for damage caused to permanent works through his backfilling operations or through the premature opening to traffic of a backfilled surface.

The minimum cover, where pipelines cross under roads, shall be 1.2 m to the top of the surrounding concrete, or such cover as may be directed by the road authorities.

Any excavated material stored on site for backfilling or other purposes shall be deposited alongside the excavation at a minimum distance of 0.5 m in such a manner that it will cause no damage and as little inconvenience as possible.

The rate for excavation shall include the costs of complying with the requirements of this clause.

4.29 Backfilling with sand or imported suitable material

Where shown in the drawings or instructed by the engineer, the Contractor shall provide and use approved sand or imported suitable material to backfill around pipes and structures to the thickness instructed by the Engineer. A rate in the Bill of Quantities shall be provided for this item.

4.30 Reinstatement of Surfaces

Generally all trenches and backfilled excavations shall be reinstated to equal surface as before excavation.

Trenches in any existing road shall be refilled to the level of natural soil below the road with sub-soil in 75 mm layers, each layer being carefully tamped with rammers. The remaining top layers shall be filled to the road surface with materials equal in type, quantity and compaction to materials used for the existing road.

The backfilled trench shall then be left to settle for 30 days. At the expiration of this period the surface shall be made up to level and tamped or rolled to the approval of the Engineer, who will decide on the particular surfacing employed in accordance with the existing surface of the road.

Before expiration of the maintenance period the Contractor shall make good any defaults in reinstatement. The rate for excavation shall include the costs of complying with the requirements of this clause.

4.31 Removal of Surplus Excavated Material

Excavated material, which is not needed either for backfilling trenches or other excavations or otherwise, shall be removed and disposed off to tipping places obtained by the Contractor. All rubbish and waste material shall similarly be removed by the Contractor. All surplus excavated material shall be spread and leveled in the tipping places in accordance with such directions as the Engineer may give, and the Contractor's rates for disposal shall include for the costs of such operations.

The Contractor shall take every practical precaution against causing any nuisance, damage, injury or inconvenience in the handling, stacking, carting or disposal of excavated materials or any other operation matter or thing in connection therewith. No excavated material shall be placed in any position where it may be washed away or may be liable to fall or spread into any private property or across a road or footpath, and should such occur, the Contractor shall forthwith remove the same at his own costs.

Should the Engineer direct the Contractor to tip certain surplus excavated materials in a particular place (other than the tipping places obtained by the Contractor) the Contractor shall abide by such instruction and shall make no charge in consequence thereof unless the place specified entails a longer haul than what would be incurred by tipping at the place or places obtained by the Contractor.

The rate for excavation shall include the costs of complying with the requirements of this clause.

4.32 Borrow Pits

No borrow pits will be allowed to be opened within the site of permanent works without the approval of the Engineer.

No separate payment will be made for acquisition, development and operating borrow sites whatsoever as the same is deemed to have been included in the Contractors rates.

All borrow sites will have to comply with national and local laws and regulations governing operations of such borrow sites. The Engineer reseves the right to order closure and reinstatement of any borrow site that might prove harmful to the public.

4.33 Rock Fill Below Structures

Where shown in the drawings or instructed by the Engineer, the Contractor shall provide and place rockfill below structures. Rockfill shall consist of clean hard broken stone or rubble with measurements not exceeding 150 mm in any one direction with sufficient lateritic gravel added to fill the interstices. The Rockfill shall be well-packed, rammed and where possible rolled with a 5 ton roller. Where rolling is impossible, compaction shall be by hand or by mechanical tampers. Before any concrete is laid on Rockfill, the rockfill shall be levelled and blinded with fine stone chippings, rolled and watered as necessary. The volume of rockfil shall be measured after compaction. A rate in the Bill of Quantities shall be provided for this item.

4.34 Grass Planting and Top Soil

Top soil shall be selected vegetable soil, well compacted and except where otherwise specified be of 150 mm thickness.

The Contractor shall trim the faces of the side slopes to open channels and elsewhere where directed to the dimensions, inclinations and curves shown on the Drawings, remove all excess material and make good all depressions with suitable material.

Where instructed by the Engineer, the Contractor shall plant locally available species of grass or as approved by the Engineer at the rate of 16 plants per m^2 corresponding to 250 mm c/c. The Engineer shall satisfy himself that natural growth of grass will not take place within a reasonable time before instructing the Contractor to grass specified areas.

The Contractor shall be responsible for obtaining suitable grass plants and for making all necessary arrangements with the owners and/or occupiers of the land from which they are to be obtained. The Contractor shall be responsible for the preparation of the surface for planting, and for maintaining adequate grass cover and necessary watering during the Contract and Maintenance Period.

The Contractor shall be required to rehabilitate all spoil areas at his own cost to the satisfaction of the Engineer.

A rate in the Bill of Quantities shall be provided for this item.

4.35 Ant-Proofing

Where an ant-proof course has been specified or instructed by the engineer, it should be made by application of Rentokil Termite Soil Concentrate or equal diluted one part concentrate to forty parts water (by weight) at the rate of 5 litres solution to 1 square meter to the whole area of the structure immediately before (36 hours maximum) the concrete is poured. Additionally to all critical areas, i.e. both sides of wall foundations, piers and porches the application should be 5 litres per running metre. Treatment should not be made when the soil is excessively wet. Precautions should be taken to prevent disturbance of the treated areas before they are covered.

4.36 Stone Pitching

Where shown on the Drawings. Or directed by the Engineer the Contractor shall excavate for, trim to line and level, provide and lay stone pitching.

Stone pitching shall be formed of hard stone, roughly dressed square.

The least dimension of any stone shall not be less than 200 mm , and the volume not less than 0.01 m^3. No rounded boulders shall be used.

The stones shall be set on edge and securely bedded with the largest dimensions at right angles to the flow of water, fittedclosely together so as to leave only a minimum of voids between the stones which shall be filled in with suitably shaped and tightly wedged spalls. The top of the pitching shall be finished flush with the adjacent material.

Where grout is specified, a 1:4 cement: sand mortar shall be rammed into the wetted interstices and smoothed off flush with the pitched face.

4.37 Gabions

Where shown on the Drawings or directed by the Engineer the Contractor shall excavate for, trim to line and level, provide and erect gabions including providing selected rock, crushed if necessary, packed and compacted inside the gabions.

Gabions shall include gabion mattresses and gabion boxes and for the purposes of construction and method of measurement and payment no distinction shall be made between them.

Gabions shall be "Maccaferri" boxes and/or "Reno" mattresses both with diaphragms at 1 metre centres, or similar approved. The maximum mesh size shall be 100 mm x 120 mm for boxes and 60 mm x 80 mm for mattresses. The wire used for the construction of gabions shall unless otherwise instructed by the Engineer comply with the requirements of Table 4-1.

TABLE 4 – 1

		Diameter (mm)	Galvanising (g/m^2)
Mesh	Box Mattress	3.4 2.7	275 260
Binder	Box Mattress	2.2 2.2	240 240
Selvedge	Box Mattress	3 .9 3.4	290 275

All wire shall be to BS 1052 having a tensile strength of not less than $40kg/mm^2$

Galvanizing shall comply with the requirements of BS 443.

Gabions shall be constructed to the shapes and dimensions as shown on the Drawings or given in the Special Specification or as directed by the Engineer. Gabions, as constructed shall be within a tolerance of +/- 5% on the height or width instructed and +/-3% on the length instructed.

The alignment of the gabion shall be correct within a tolerance of 100mm of the instructed alignment and the level of any course of gabion shall be correct to within a tolerance of 50mm of the instructed level. In addition adjacent gabions shall not vary by more than 25mm in line and/or level from each other

The surface upon which gabions are to be laid shall be compacted to a minimum dry density of 95% MDD (AASHTO T99) and trimmed to the specified level or shape.

Joints in gabions shall be stitched together with 600mm minimum lengths of binder wire, with at least one stitch per 50mm, and each end of the wire shall be fixed with at least two turns upon itself.

Adjacent gabions shall be stitched together ·with binder wire along all touching edges.

Gabion boxes shall be laid with broken bond throughout to avoid continuous joints both horizontally and vertically. Pre-tensioning of gabions shall be subject to the approval of the Engineer.

Gabions shall be handpacked with broken rock of 150 mm minimum dimension and 300mm maximum dimension. The sides shall be packed f irst in the form of a

wall, using the largest pieces, with the majority placed as headers with broken joints to present a neat outside face. The interior of the gabion shall be hand packed with smaller pieces and the top layers shall be finished off with larger pieces.The whole interior and to layers shall be packed tight and hammered i nto place.

Where instructed by the Engineer the Contractor shall place filter fabric ('Terram' or similar approved) behind gabion faces in contact with existing or backfilled ground. The Contractor shall ensure that the filter fabric is not damaged during the construction or backfilling around the gabion works and any damaged or torn fabric shall be replaced at the Contractor's expense. The filter fabric shall be installed in accordance with the manufacturer's instructions and the filter fabric shall not be left exposed to sunlight for more than 3 weeks.

At the back face and ends of completed gabion work or where shown on the Drawings or instructed by the Engineer the existing soil shall be backfilled, thoroughly compacted against the sides of the gabions and finished flush with the top surface of the gabion.

On completion of gabion constroction the exposed joints shall be painted with thick bitumen to the approval of the Engineer to discourage vandalism

4.38 Measurement and Payments

a. Clause 4.3: Excavation in Soft material

I) Excavation for trenches in Soft Material

Unit:. m^3

Excavation for trenches in soft material shall be measured in cubic meters calculated as the product of the width of the excavation given is clause 4.6 of this specification and the sectional area. The sectional area of the excavation, measured in square meters shall be calculated by the product of the average depth of the excavation and the instructed length of the trench. The average depth shall be measured from the instructed final profile.

The rate for excavation in trenches in soft material shall include for the cost of excavation to any depth, trimming and levelling, backfilling with excavated material or removal excavated material to spoil if it is unsuitable or surplus to requirements, and complying with the requirements of clauses 4.3.1, 4.3.2, 4.3.3, 4.6, 4.7, 4.9 and 4.10 of this specification.

II) Excavation for Structures in Soft Material

Unit:. m^3

Excavation for structure in soft material shall be measured by the cubic meter, calculated as the product of the net plan area of the foundation to be excavated and the average depth of the excavation. No allowance will be made for working space. The average depth shall be calculated as the difference between the original ground level as agreed in clause 1.26 of this specification between the engineer and the contractor, and the required level.

The rate for excavation for Structure in soft material shall include for the cost of excavation to any depth, Compaction of the foundation level of the excavation, backfilling with excavated material or removing the excavated

material to spoil if it is unsuitable or surplus to requirements, and complying with the requirements of clauses 4.3.1, 4.3.2, 4.3.3, 4.7, 4.9 and 4.10 of this specification.

b. Clause 4.4: Excavation in Hard Material

Unit:. m^3

Hard material encountered in any excavation shall be measured by the cubic meter, calculated as the product of the average end area measured at intervals agreed with the engineer along the centreline of the excavation. No allowance will be made for working space.

The rate for excavation in hard material shall include for the cost of excavation to any depth, Compaction of the foundation level of the excavation or trimming and levelling, backfilling with excavated material or removing the excavated material to spoil if it is unsuitable or surplus to requirements, and complying with the requirements of clauses 4.3.1, 4.3.2, 4.3.3, 4.4, 4.5, 4.6, 4.7, 4.9 and 4.10 of this specification.

c. Clause 4.7 Backfilling with sand or imported suitable material.

Unit m^3

Sand or imported suitable material shall be measured by the cubic meter, calculated as the product of the average end area (excluding any pipe or concrete surround) and the length of the suitable backfill material instructed to be placed.

The rate for suitable backfill material shall include for the cost of providing the material, backfilling at any depth, all the hauls as necessary and complying with the requirements of clauses 4.7 and 4.8 of this specification.

d. Clause 4.11: Rock fill below Structures

Unit: m^3

Hard-core filling shall be measured by cubic metre calculated as plan area and average depth of hard-core fill instructed.

The rate for hard-core filling shall include for the cost of providing, placing the material, compacting, all the hauls as necessary and complying with the requirements of clauses 4.12 of this specification.

e. Clause 4.12 Grass planting and top soil placing

Unit: m^2

Grass planting and top soil placing shall be measured as **plan area** in square meters instructed.

The rate for grass planting and top soil placing shall include for the cost of providing grass and suitable top soil, placing, planting, watering, all the hauls as necessary and complying with the requirements of clauses 4.13 of this specification

f. Clause 4.13 Ant Proofing

Unit: m^2

Ant proofing shall be measured as **plan area** in square meters instructed.

The rate for ant proofing shall include for the cost of providing, placing, and complying with the requirements of clauses 4.14 of this specification

g. Clause 4.14 Item : Stone pitching

Unit: m^2

Stone pitching shall be measured by the. square metre calculated as the net area , measured on the slope , instructed by the Engineer.

The rate for stone pitching shall include for the cost of excavating, trimmingto line and level, grouting. providing and laying the stone and of complying with the requirements of clause 4.16 of this specification. Grouting of stone pitching shall include for providing the sand, cement, mortar, wetting of the stone to be grouted, ramming the grout into the interstices and smoothing off: flush with the pitched face and complying with Clause 4.16 of this Specification.

h. Clause 4.15 Item : Gabion Boxes

Unit : No.

Gabion boxes shall be measured by the Numbers calculated as the net area of material required to construct the gabions, including diaphragms.

The rate for gabion mesh shall include for

a. the cost of providing and fixing the mesh and the cost of complying with requirements of Clause 4.15 of this Specification.
b. the cost of excavation to any depth, compaction of the surfaces to receive the gabions, backfilling with the excavated material or removing the excavated material to spoil if surplus to requirements, and complying with the requirements of other Clauses in section 4 of this Specification.
c. the cost of providing, hauling and placing the rock and the cost of complying with the equirements of Clause 4.15 of this Specification.

i. Item : Filter fabric under and/or behind gabions

Unit : m^2 of each weight a fabric specified

The filter fabric placed under and/or behind gabions shall be measured as the net area of filter fabric instructed.

The rate for filter fabric shall include for the cost of the preparation of the surface to receive the filter fabric, the provision, transport, storing and laying the fabric in accordance with the manufacturer's instructions, all laps and/or stitching and for complying with the requirements of Clause 4.15 of this Specification.

5. DRILLING AND GROUTING

5.1 General

Scope

The work to be included under this Chapter shall comprise the supply of all labour, equipment and materials, and the performance of all work necessary for drilling though concrete or rock washing and pressure testing grout holes and supplying transporting, mixing and injecting grout materials; supply and installation of grouting pipes, headers, risers, grooves and grout outlets; core drilling and water pressure testing test holes; all as shown on the Drawings or as directed by the Engineer and as specified herein.

The location, direction, and depth of each grout bole shall be as shown on the Drawings or as directed by the Engineer. The order in which the holes are drilled and the manner in which a hole is drilled and grouted, the proportions of all grout mixes, the time of grouting, the pressure used in grouting, and all other details of the grouting operation shall be as specified herein or as directed by the Engineer.

Modifications to the techniques for drilling and grouting may be required as knowledge and experience of the rock and the foundation conditions on the Site are gained. The Contractor will be required to alter his operation promptly to meet such modifications as may be instructed by the Engineer.

The amount of drilling and grouting that will be required is uncertain and the Contractor shall not be entitled to additional compensation above the unit rates stated in the Bill of Quantities by reason of increase or decrease of such quantities.

The Contractor shall employ an approved expert to carry out grouting work unless he can satisfy the Engineer that he is experienced in this class of work, that he has previously carried out similar work of comparable magnitude and that he possesses the necessary equipment and skilled staff The Contractor shall be entirely responsible for the workmanship and proper execution of all classes of drilling and grouting works. The personnel used for these operations shall be skilled and experienced in such works and under the direct control of a supervisor having more than 10 years' experience in this specialty.

Prior to commencement of any drilling and grouting, the Contractor shall submit to the Engineer for approval a detailed programme stating the order of work he proposes to follow and full details of his proposed methods, materials and equipment including its layout.

Consolidation and curtain grouting works shall be preceded by water pressure testing of the drilled hole unless otherwise directed by the Engineer. The purpose of this test is to obtain information on the rock quality in order to determine the consistency of the grout to be used and to wet the surface of rock seams in order to avoid premature sealing of the seam by thickening of the grout mixture.

All grouting operations shall be performed in the presence of the Engineer. Once grouting of a hole is commenced, the grouting operation shall not be discontinued before completion of the bole unless otherwise directed by the Engineer.

Contractor shall submit to the Engineer each day a detailed record in the form approved by the Engineer of all of drilling, grouting and incidental operations earned out on the previous day.

On completion of the grouting of a hole, the Contractor shall provide the Engineer with a complete log in duplicate of the grouting work in that hole. Details shall include:

- hole number and coordinates
- lugeon value of each stage at the time of water pressure test
- actual injection record in detail (concentration, pressure, injection time, injection quantities) presented in tables and figures.
- Miscellaneous records and data as directed by the Engineer.

Unless otherwise approved, no grouting operation shall be made until all concrete within a distance of 15m has been in place for at least 4 weeks, and drilling and water pressure testing shall not be performed within a distance of 15m from a hole which is in the grouting operation.

After the grouting work has been completed the Contractor shall clean the work site to the satisfaction of the Engineer.

5.2 Definition Of Grouting

In the context of this specification, grout is a mixture of cement and water or cement sand and water with admixture as approved.

Grouting operation will include:

Backfill grouting – for filling any voids left by incomplete filling between the concrete lining in a tunnel and the surrounding rock, or between the concrete lining and any concrete subsequently placed in the tunnel (e.g tunnel plug) by injecting sand - cement grout into the voids

Contact grouting – means grouting the contact between foundation material and structure by grouting the upper part of curtain grout holes, consolidation grout holes or by means of short holes drilled for the purse or pre—set grout pipes. Contract grouting is for sealing any shrinkage gaps between the lining concrete and surrounding rock or between the lining concrete and any concrete subsequently placed in the tunnel. This operation is undertaken after backfill grouting operations and by injecting cement grout. This grouting also include sealing any shrinkage gaps between the steel and penstock liner and surrounding concrete in the headrace tunnel and around the spiral casings and draft tubes in power stations

Consolidation grouting – for sealing and strengthening the rock foundations along the dam axis and of the intake tower etc. by injecting cement grout under low pressures to fill any joints, cracks and fissures.

Curtain grouting – means one or more rows of deep holes drilled into the rock and grouted to provide a continuous impermeable curtain to creating a water barrier at locations along and under the dam core trench, weir, cutoff walls etc by injecting cement grout under high pressure to seal any joints, cracks and fissures. This grouting performed after consolidation grouting operations have been completed in that location.

Pre-injection grouting – for control groundwater flow which may be at high pressure, consolidate and stabilize the ground through which tunnels and shafts shall be driven and create as far as possible uniform and safe tunnel driving and

shaft sinking condition, by grout ahead of tunnel faces or below shalt bases on a systematic basis

"**Depth**" means the distance from the start of the hole regardless of direction.

"**Stage**" means a partial or complete Length of hole in which grouting is performed.

"**Grouting in progress procedure'** means the procedure of drilling a hole to a limited depth. setting a packer and grouting the hole, permitting the grout injected around the hole to set sufficiently to prevent its entering the hole when the hole is cleaned, cleaning out the hole, drilling the hole to a deeper stage, setting a packer at the bottom of the previously grouted stage or elsewhere as directed by the Engineer, grouting the new stage, and thus continuing in as many cycles of drilling and grouting as are required.

"**Grouting in reverse procedure'** means the procedure of drilling a hole to full depth in one operation and grouting from the end of the hole towards the surface in successive stages by setting the packers at predetermined depths.

"**Primary holes** means holes that are drilled and/or grouted before secondary holes.

5.3 Report to be Submitted for Approval By The Engineer

Prior to commencement of drilling and grouting operations, or at such other times as specified the Contractor shall submit to the Engineer the following:

5.3.1 Description

For approval:

- Technical references of the Contractor and of his personnel to be employed on drilling and grouting works:
- A list of the proposed equipment and Installations for executing and monitoring drilling, water testing and grouting.

5.3.2 Cement, bentonite, admixtures and other materials

- Manufacturer's test certificates for all materials to be used for grouting (for Engineer's approval).
- During grouting operations, the Contractor shall submit to the Engineer for information:

  a) Results of chemical and physical analysis,

  b) Weekly materials input—output records.

5.3.3 Injection grout

For approval:

- Provisional programme for grout mix design for each specific work;
- Results and conclusion of the trial mixes for grout.

5.3.4 Programme of works and method of execution

For review two weeks before commencement of the works

- Detailed programme of drilling, water testing and grouting.

- Report on the method of execution and particularly the sequence of works, the maximum grouting pressure, the rate at which the grout is injected, the pressure application (continuously or by stages) and the composition of the grouts for each specific work. The method of execution will he defined by preliminary in situ tests which shall be carried out under the continuous supervision of the Engineer.
- Quality assurance manual detailing the measures proposed to ensure the specified quality, including control and tests.

5.3.5 Daily Report

- At each grouting work-place, the Contractor shall keep a diary, available at any tine to the Engineer, a copy of which is to be furnished within 24 hours, recording for every shift the following data:
- Holes drilled: number, location, elevation of borehole head. Inclination, date of starting and completing any operation, works completed after each shift, drilling progress:
- Personnel, plant and equipment assigned to the work with main characteristics;
- Grouting work carried out: grout mixes, levels of grouting. injected volumes of grout with corresponding pressure and weight of dry materials absorbed;
- Samples taken and tests carried out. For water test pressure: packer depth, length of test section, plot of water loss versus time, testing pressure, rise (if any) in water level above packer during test;
- Description of all Incidents occurring during drilling, water test and grouting and generally all Information in conjunction with the work.

5.3.6 Synthetic drawing

The Contractor shall prepare color synthetic drawings updated on daily basis showing for the developed cross section along the grout curtain the grout takes for the different stages in the different grout holes. The format of these drawings shall be submitted to the Engineer for approval. Conventional colors shall be used for different grout takes in kg of dry material per metre of grout hole.

5.3.7 Quality control Report

Two months after the end of each section of work, the Contractor shall submit to the Engineer quality control reports.

5.4 Grout Material

Grout shall consist of a mixture of cement and water, with the addition of admixtures if and as approved. The mix proportions will depend on investigations and geological conditions encountered and will be determined by the Engineer.

Cement, water and sand shall comply with the following requirements

The Contractor shall submit to the Engineer full details of all materials which he proposes to use for making concrete. No concrete shall be placed in the works until the Engineer has approved the materials of which it is composed. Approved

materials shall not thereafter be altered or substituted by other materials without the consent of the Engineer.

5.4.1 Cement

Cement shall comply with the following Kenya Standard KS1725:2001 CEM 1 42.5N for Ordinary Portland Cement.

Cement shall be free flowing and free of lumps. It shall be supplied in the manufacturer's sealed unbroken bags or in bulk. Bagged cement shall be transported in vehicles provided with effective means of ensuring that it is protected from the weather.

In addition, cement for grouting works shall meet the following requirement:

- Cement resistant to fresh water (such as slag cement, pozzolanic cement or equivalent).
- No particle coarser than 50 microns.
- Maine fineness higher than 4 cm2/g.

Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well ventilated at all times. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through it.

Each delivery of cement in bags shall be stacked together in one place. The bags shall be closely stacked so as to reduce air circulation but shall not be stacked against an outside wall. If pallets are used, they shall be constructed so that bags are not damaged during handling and stacking. No stack of cement bags shall exceed 3 m in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks.

Cement from broken bags shall not be used in the Works.

Cement in bags shall be used in the order in which it is delivered.

The Contractor shall provide sufficient storage capacity on site to ensure that his anticipated programme or work is not interrupted due to lack of cement.

Cement which has become hardened or lumpy or fails to comply with the Specification in any way shall be removed from the Site.

All cement shall be from the same source.

All cement used in the works shall be tested by the manufacturer or the Contractor in a laboratory acceptable to the Engineer.

The tests to be performed shall be directed by the Engineer and the Contractor shall supply two copies of each certificate to the Engineer.

Testing

Cement for grouting works:

Initial approval of cement:

The following tests shall be carried out:

- Minimum compressive strength at 7 and 28 days.
- Initia1 setting time.

- Blaine specific surface (or fineness).
- % passing 50 micron sieve.

Verification of cement delivered:

The following checks shall be carried out for each delivery of cement or at least every 25 tons:

- Compressive strength at 7 and 28 days.
- Initial setting time.
- Elaine specific surface (or fineness).
- % passing 50 micron sieve.

Each set of tests carried out by the manufacturer or Contractor shall relate to not more than one day's output of each cement plant, and shall be made on samples taken from cement which is subsequently delivered to the Site. Alternatively, subject to the agreement of the Engineer, the frequency of testing shall be one set of tests for every 25 tonnes of cement delivered to Site from each cement plant.

Cement which is stored on Site for longer than one month shall be re-tested in the laboratory of the Materials Branch of the Ministry of Transport and Communications or at the Kenya Bureau of Standards at the rate instructed by the Engineer.

Cement which does not comply with the Specification shall not be used in Works and it shall be disposed of by the Contractor.

The Contractor shall keep full records of all data relevant to the manufacture, delivery, testing and use of all cement used in the Works and shall provide the Engineer with two copies thereof.

5.4.2 Sand

Sand shall be clean, hard, durable and of proper grading and it shall be free from objectionable quantities of dirt, silt, organic matter and other deleterious materials. Sand shall pass a 2.5mm standard screen in 100% and pass a 0.6mm screen in not ;less than 50%

The sand shall not contain iron pyrites or iron oxides. It shall not contain mica, shale, coal or other laminar, soft or porous materials or organic matter

Other properties shall be as set out below:

- Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.05 per cent by weight expressed as chloride ion when tested as set out in BS 812.
- Sulphates soluble in a 10 per cent solution by weight of hydrochloric acid shall not exceed 0.4 per cent by weight expressed as SO3, when tested as set out in BS 1377.
- Soundness: After five cycles of the test in AASHTO T104 the aggregate shall not show a weight loss of more than 10 per cent.
- Organic impurities: If the test as directed by the Engineer shows that more than a trace of organic impurities is present, the fine aggregate shall not be used in the Works.

Testing Sand

Acceptance testing

The Contractor shall deliver to the Engineer samples containing not less than 50 kg of any aggregate which he proposes to use in the Works and shall supply such further samples as the Engineer may require. Each sample shall be clearly labeled to show its origin and shall be accompanied by all the information called for in BS 882.

Tests to determine compliance of the aggregates with the requirements and shall be carried out by the Contractor in a laboratory acceptable to the Engineer. If the tested materials fail to comply with the Specification, further tests shall be made in the presence of the Contractor and the Engineer and acceptance of the material shall be based on such tests.

A material shall be accepted if not less than three consecutive sets of test results show compliance with the Specification.

Compliance testing

The Contractor shall carry out routine testing of aggregates for compliance with the Specification during the period that grouting is being produced for the Works. The tests set out below shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to Site provided that no set of tests shall represent more than 250 tonnes of fine aggregate nor more than 500 tonnes of coarse aggregate, and provided also that the aggregates are of uniform quality. If the aggregate from any source is variable, the frequency of testing shall be increased as instructed by the Engineer.

Grading	BS 812
Silt and clay contents	BS 812
Moisture content	BS 812
Check on organic impurities	As directed by the Engineer

In addition to the above routine tests, the Contractor shall carry out the following tests at the frequencies stated:

Moisture content; as frequently as may be required in order to control the water content of the grout as required by the Specification.

Chloride content: as frequently as may be required to ensure that the proportion of chlorides in the aggregates does not exceed the limit stated in the Specification.

The Contractor shall take account of the fact that when the chloride content is variable it may be necessary to test every load in order to prevent excessive amounts of the chloride contaminating the concrete. For this purpose the Contractor shall use the rapid field test (Quantab test). In the event of disagreement regarding the results of the field test, the chloride content of the aggregate shall be determined in the laboratory as described in BS 812 (Volhard test).

(f) Delivery and storage of aggregates

Aggregates shall be delivered to Site in clean and suitable vehicles. Different types or sizes of aggregate shall not be delivered in one vehicle.

Each type or size of aggregate shall be stored in a separate bin or compartment having a base such that the contamination of aggregate is prevented. Dividing walls between bins shall be substantial and continuous so that no mixing of types or sizes occurs.

The storage of aggregates shall be arranged so that as far as possible rapid drying out in hot weather is prevented in orders to avoid sudden fluctuations in water content. Storage of fine aggregates shall be arranged so that they can drain sufficiently before use in order to prevent fluctuations in water content of the concrete.

5.4.3 Water for Grouting

Seawater or brackish water containing more than 1000 ppm chloride ion or 2000 ppm sulphate ion shall not be used for mixing of grout.

Water shall be clean and free from harmful matter and comply with the requirements of BS 3149.

The Contractor shall carry out tests in accordance with BS 3148 to establish compliance with the Specification.

5.4.4 Admixtures

General

Chemical admixtures(as non-shrinking agents or to improve the pumpability of the grout mix) may be used subject to the approval of the Engineer. Compatibility of the cement with the intended admixture(s) shall be tested by the Contractor before use.

The use of the admixtures in concrete may be required under the Contract to promote special properties in the finished grout or may be proposed by the Contractor to assist him in compliance with the Specification.

In all cases the Contractor shall submit to the Engineer full details of the admixture he proposes to use and the manner in which he proposes to add it to the mix. The information provided shall include:-

- The typical dosage, the method of dosing and the detrimental effects of an excess or deficiency in the dosage.
- The chemical names of the main active ingredients in the admixture.
- Whether or not the admixture contains chlorides, and if so the chloride ion content expressed as a Percentage by weight of admixture.

- Whether the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage and if so, the extent to which it does so.
- Details of previous uses of the admixture in Kenya.

The chloride ion content of any admixture shall not exceed 2 per cent by weight of the admixture nor 0.03 per cent by weight of the cement in the mix.

Admixtures shall not be mixed together without the consent of the Engineer.

5.4.5 Bentonite

Bentonite to be used in grouting work shall not contain:

- Anything capable of inhibiting cement setting.
- Particles exceeding 50 microns. Bentonite shall above a Plasticity Index greater than 400.

Bentonite shall be delivered in bags which shall be stocked in accordance with the provisions laid down for cement

The following checks shall be carried out for each delivery of bentonite:

- Plasticity index.
- 50 micron sieve passing.
- Cement compatibility (28-day grout strength).

5.5 Grout Composition

The grout for injection shall be, made of water, cement, sand, bentonite and admixture as required.

The grout mix design process for each kind of grouting work shall include the following tests:

- Settling, measured as the ratio between the volume of water appearing above the grout and the total volume in a 1 litre. 6 cm dia test tube, after 20. 40, 60, 80, 100 and 120 minutes and after setting.
- Setting time (ASTM C 191).
- Viscosity with standard Harsh cone (4.75 mm dia.) (API 13.B).
- Density.
- Flexural and uniaxial compressive strength at 28 days on 4x4x16 specimen (ASTM C 78).
- Compatibility between the various components.

Trial mixes shall be carried out using a mixer which reproduces the same type of high turbulence produced by site mixers and using the same materials as those which will actually he used on site.

The composition of the grout shall be adjusted depending on the actual conditions encountered.

5.6 Curtain Grouting

The Contractor shall perform curtain growing of rock foundations at along the dam axis, and elsewhere as shown on the Drawings or as directed by the Engineer, in order to reduce the permeability of the rock and create a water barrier.

Unless otherwise directed by the Engineer, curtain grouting operations shall not be commenced earlier than 15 days after consolidation grouting is completed at the location.

The Holes will vary from 10m to 60m and pressure will vary from 0.1 to 1.0 N/mm2 depending on the geological conditions. Grouting shall be commenced after conducting a water pressure test as described in this specification. Grouting shall be performed in 5m stages, either upstage or downstage as directed by the Engineer. For upstage grouting, the hole shall be drilled to the full depth and grouting carried out from bottom to the collar of the grout hole using parker at 5m stages. Where downstage grouting is directed, the hole shall be progressively drilled and grouted in 5 m stages down to full depth.

All aspects of drill hole patterns, closure holes, water pressure testing, grout mix proportions, pressure and all grouting operations shall be as approved by or directed by the Engineer.

Re-drilling and drilling for a subsequent stage shall not be permitted to start earlier than 12 hours after completion of the preceding stage to prevent washing out of grout.

The grout shall consist of water and cement, in proportions directed by the Engineer. Grouting operations, completion of holes and treatment of leakage shall follow procedures described for consolidation grouting above.

5.6.1 Procedure Curtain Grouting

The curtain grouting shall be carried out either by reverse procedure or progress procedure as defined hereafter. The normal procedure shall be to reverse procedure. The Engineer may require to use the progress procedure where or geological conditions (hole instability or water loss) are encountered during the drilling of the hole.

Reverse procedure

Reverse procedure comprises the following:

- Drill the hole by 5 m long sections:
- Clean the hole: -
- Carry out water pressure test in each section;
- Carry on the procedure till the bottom of the hole:
- Set a packer at the furthest section to be grouted:
- Grout the section beyond the packer:
- Allow the packer to remain in place until there is no back pressure;
- Withdraw the packer and re-set it at the next stage.
- Repeat the procedure until the hole is completely grouted.

Progress procedure Progress procedure comprises the following:

- Drill the hole to the bottom of the 5m long section to be grouted:
- Clean the hole;
- Set a packer at the top of the section;
- Carry out water pressure test in each section;
- Grout the section beyond the packer;
- Wash or re-drill the section of the hole grouted as soon as the grout in rock adjacent to the hole has set sufficiently to prevent it being washed into the hole. Washing or redrilling shall be chosen according to actual rock conditions;
- Carry out simplified water test and report out if directed;
- Drill to the next stage and repeat the procedure.

5.6.2 Stages of work

First stage (primary holes)

The spacing of primary holes shall be 8 m;

- The holes shall be drilled with continuous coring and/or without coring, as directed by the Engineer. The drilling pattern shall take due consideration of grouting restrictions given in(e);
- Unless otherwise specified by the Engineer, water pressure tests shall be Lugeon tests in holes drilled with continuous coring and simplified water test in holes drilled without continuous coring;
- Then grouting shall be performed as described herein

2. Second stage (secondary holes between the primary holes):

- Unless otherwise instructed by the Engineer secondary holes shall be drilled where more than 5 UL (Unit Lugeon) has been measured during water test in one of the adjacent holes or when takes larger than 40kg dry material per metre above been observed in the primary holes;
- The holes shall be drilled without coring except as otherwise directed;
- Water tests shall be simplified water tests;
- Then grouting shall be performed as described herein.

Third stage

Third stage (tertiary holes between the primary and secondary holes)

- Unless otherwise instructed by the Engineer tertiary holes will be drilled where more than 5 UL above been measured during water test in secondary holes or when takes larger than 40 kg dry material per metre above been observed in the secondary holes.
- The holes shall be drilled without coring except as otherwise directed.
- No water tests shall be required except as otherwise directed by the Engineer.
- Then grouting shall be performed as described herein.

5.6.3 Grouting criteria

The following criteria shall be adjusted to the preliminary in situ test and according to the actual grouting conditions:

Unless otherwise instructed by the Engineer, the maximum grouting pressure shall be given by:

$$P=0.05\ z$$

p: maximum grouting pressure in Mpa

z: depth in metre of the grouted area below the top of the grout hole.The minimum grouting pressure shall be 0.2 Mpa.

Grouting of any hole shall be considered as completed when at the refusal pressure the rate of grouting is less than 2 L/mn per 5 m section during 2 successive periods of 5 minutes.

The minimum distance between any section of primary hole under grouting and another hole not grouted shall be 15 m except as otherwise directed by the Engineer, where the geological conditions so require.

5.7 Grout Criteria

- Setting time less than 24 hours.
- Settling after 2 hours lower than 5%.
- Viscosity: to be adjusted for each specific work within the range 30-50s. with a tolerance on the specified viscosity of + or - 55.
- uniaxial compressive strength after 28 days: > 2 MPa

5.8 Equipment

5.8.1 Drilling Equipment

Grout holes shall be drilled with either rotary type drills or percussion type drills, provided that where holes for subsequent grouting cannot be chilled satisfactorily with percussion type drills, the rotary type drills will be directed by the Engineer.

Unless otherwise specified herein, shall be made with rotary type drills. The minimum diameter of each grout hole shall not be less than 38 mm. Only electric or air-driven equipment shall be used in underground works.

For consolidation grouting, drilling equipment shall be capable of drilling to a depth of 10m. Diameter of holes shall not be less than 38 mm.

For curtain grouting, equipment shall be capable of drilling to a depth of 60m Diameter of boles shall not be less than 45 mm. Bits shall be non-coring type.

The holes shall be drilled using sufficient circulation of water (0.1litre/second minimum) and sufficient pressure to flush all drill cuttings from the holes. Percussion drills shall be fitted with a water swivel or other device for continuous flushing of the hole.

For core drilling of test holes, standard rotary drilling equipment capable of drilling to a depth not less than 75m in with a hole diameter not less than 65 mm shall be used. Core barrels shall be “double or triple tube swivel type” or wireline type”. For high core recovery of soft weathered rock zone, core barrel of spring loaded retractor type shall also be prepared. The diameter of the core hole shall be not less

than 65 mm, or less than 82 mm if casing of the hole is required. The Contractor shall submit details of the drilling diameter and the equipment he proposes to use to ensure the maximum core recovery.

5.8.2 Water Pressure Testing Equipment

Water pressure testing equipment shall include single packer type or double packer type water pressure test assemblies, water storage facilities, flow-meters, pressure gauges including gauge protectors, valves, hoses, fittings and pumps capable of delivering at least 60 litres/min, at 2.0 N/mm2 of maximum pressure and maintaining constant pressures. Packers shall be the mechanically expanding rubber ring type and/or the pneumatically expanding rubber sleeve type (air packer) of sizes to fit the diameter of drill holes. The type of packer shall be varied to Suit rock conditions, as directed by the Engineer.

5.8.3 Grout Plant

The grout plant shall be a type approved by the Engineer and shall be capable of supplying, mixing, agitating and pumping grout to fulfill the following requirements;

Grout pumps of reciprocating piston type or rotating screw-type, having a capacity to force thick grout (water-cement ratio, 0.6:1) into the grout holes or grout connections in a continuous, uninterrupted flow at any pressure up to a maximum of 1.5 N/mm2, and at the maximum discharge of not less than 60 liter/minute.

Mixers of a mechanical operated, double drum, high speed (more than 800 r.p.m.) colloidal type with each drum capacity of not less than 200 litres. The mixing time of each batch shall be a minimum of 2 minutes.

Facilities for the accurate measurement of the grout materials by volume and weight shall be provided at the mixer so that mix proportions can be accurately controlled within an accuracy of +2%.

Valves, water meters, pressure gauges including gauge protectors, pressure hoses, pipes, fittings and tools as may be necessary to provide a continuous supply of grout and accurate pressure control. An accurately calibrated high precision gauge (with certificate from testing laboratory) shall be supplied for checking the accuracy of all gauges used in the grouting system. Such gauge shall be recalibrated every ninety (90) days by a certified laboratory, or as directed by the Engineer.

The grouting equipment shall be maintained in a manner satisfactory to the Engineer and shall be capable of continuous and efficient performance during any grouting operation. The arrangement of the grouting equipment shall be such as to provide a supply line and return line from the grout hole to the grout pump. Provision shall be made to permit continuous circulation and accurate control of grouting pressures and grout flows into the grout holes. The equipment shall be capable of maintaining the required pressure after the holes refuse to accept grout.

Prior to commencing grouting operations, and at any time during the progress of the work when so directed by the Engineer, the Contractor shall check and calibrate all pressure gauges, automatic level recorders and discharge meters. The corresponding data shall be submitted to the Engineer.

5.8.4 Embedded Pipes and Fittings

All metal pipes and fittings for grout hole connections and air vents shall be furnished and installed by the Contractor. All pipes shall be 50 mm diameter (or larger) carbon steel black pipe and the fittings shall be malleable iron. All pipes required for the work shall be cut, threaded...and installed with a collar attached for hookup purposes.

Care shall be taken to prevent damage to or clogging of the pipes. Any pipe which becomes clogged or obstructed prior to use shall be cleaned out or drilled or replaced at the expense of the Contractor.

5.9 Drilling for Grouting

Prior to any drilling operation from excavations, the relevant excavations shall above been approved by the Engineer.

Should the case apply, the contractor shall submit the design of working platform and scaffolding to the Engineer for information. Before and during grouting operations, the Contractor shall do the following:

Notify the Engineer when the drilling operation is ready to commence;

Before every water test and injection, inspect for obstruction: supply lines, packers and fittings;

At least every week calibrate all measurement apparatus.

The drilling method shall be submitted to the Engineer for approval.

The use of grease to lubricate the drilling rods is forbidden.

The use of lubricant to grease the cutting shall be submitted to the approval of the Engineer, after execution of laboratory tests slowing the lubricant is not harmful for the quality of the injection, the setting and resistance of the grout.

Holes shall be located within a limit of

- 5 cm from the Indicated position.
- 1^{o} from the Indicated direction.
- 1^{o} from the indicated tilt angle.

All holes are to be cleaned with jet of air and water at 0.7 MPa after each drilling stage so as to remove all debris, drill cuttings and dust which could clog the inner surface of the hole, In case of complete loss of water during drilling of be to be injected, the filling is to be stopped and the section grouted where the loss is observed.

Drilling through concrete less than 7 days old is not permitted, except if stand pipes above been previously placed into the above considered concrete.

Drilling patterns, including the depth, inclination, direction, layout, spacing and number of holes, shall be as shown on the Drawings or as directed by the Engineer. For consolidation and curtain grouting, the drilling order of holes shall generally be planned in such a pattern that the primary holes shall be drilled alternately so that their effectiveness can be checked and assured by the secondary holes which will be drilled at the middle of them (split spacing method). Additional holes may be ordered at the middle of the secondary holes, if necessary.

The use of lubricants such as metallic salts or mineral soaps in the circulation water to help the drilling process or to reduce the wear on the drillbits shall be subject to the approval of the Engineer. These products shall not impair the quality of the grouting or the setting of the grout. Use of grease and oil shall under no circumstances be permitted.

Grouted boreholes and adjacent holes shall not be re-drilled and/or drilled before the grout has set to prevent washing out. Prior to commencement of re-drilling, the grout level shall be measured and agreed with the Engineer.

Immediately prior to each grouting operation, boreholes shall be adequately flushed clean. Washing shall be done with water and air under pressure; the pipe shall be inserted to the full depth and washing shall be continued until the reappearing water is absolutely clean and clear.

5.10 Water Pressure Test

Prior to commencement of grouting in each stage of consolidation and curtain grouting, a water pressure test shall be done for the purpose of assessing the rock condition before grouting. A packer shall be set tightly and clean water shall be pumped into the hole under constant pressure. Injection of water shall be continued at least for 10 minutes for each pressure after the injection rate becomes stable.

The testing pressure will be directed by the Engineer and shall not exceed the grouting pressure, unless otherwise directed by the Engineer.

The Contractor shall record all necessary data of the test such as the hole and stage number, ground water level, pressure, injection rates and height of pressure gauge from the neck of the hole.

a) Water pressure test equipment shall include:

- Single—packer and double—packer types allowing reduced head loss of water suitable for use in holes in diameters drilled on site:
- Pump with an output of not less than & 3 1/mn at a pressure of 2 mpa and 50 L/mm at 3 Mpa.
- Air cylinder to stabilize the pressure:
- Volumetre with an accuracy of one litre:
- Pressure gauge with a precision of 10% of the pressure to be measured:

b) The equipment shall allow a test pressure of 3 mpa.

c) Precision control gauge shall always be available to allow a field calibration throughout the pressure testing work.

d) The contractor shall make available Inflatable packers of 1 m to 1.5 m in length to allow the possibility of undertaking water tests in fractured zones where shorter packers would he by-passed.

5.10.1 Procedure For Water Pressure Testing

a. General

During drilling, water pressure tests are to be performed as specified or as ordered by the Engineer, in order to finalize the depth of the hole, to estimate grout take and to select initial water—cement ratio.

Water pressure tests shall be carried out in 5 metre sections (or less if requested by the Engineer) plugged by single—packer for tests carried out in the bottom section of hale and double-packer for tests carried out in any part of hale.

Water used shall be clean (max content of suspended matter: 2000 ppm).

Water is to be pumped into the section and pressure adjusted by stage to reach the constant effective pressure at the top of the section.

Water level above the packer is to be checked and recorded.

Packers are to be displaced and water pressure test redone if a variation of water level above the packer Is observed during the test.

5.10.2 Lugeon Test

Lugeon unit is defined as the time—rate of water loss in litre per minute per metre of test section for a constant pressure of 1 Mpa for a period of 10 minutes.

Following pressure stabilization, record the flow of water at one minute intervals, for10 minutes.

Carry out tests at increasing then decreasing pressures of 0.20: 0.50: 1. 0.50: 0.20 KPa.

5.10.3 Simplified water test

Simplified water test is carried out at the maximum grouting pressure of injection of the section tested.

Following pressure stabilization, record the flow of water at one minute intervals, for 5 minutes.

If the maximum grouting pressure is not reached at a flow of 60 L/mm. Stop the test and record the effective pressure.

For each test the following is to be recorded:

1. Identification of the hole;
2. level(s) of the packer(s):
3. Sketch of the test equipment;
4. Level of water (if any) in the borehole before and after the test.
5. Level of water (if any) above the packer during the test;
6. Level of pressure gauge:
7. Head between the pressure gauge and the tested section (in pipes, tees, bends. joints, valves.
8. For Lugeon test:
   i. Graphs are to be made showing the discharges in relation to the pressure. All graphics shall be at the same scale.
   ii. Result in Lugeon unit.
9. For simplified water test, Flow of water in L/mn/m at the maximum grouting pressure, or effective pressure recorded in case the maximum grouting pressure is tot reached at a flow of 60 l/mn,
10. 10. Description of abnormal phenomena with their explanation.

5.11 Grouting Operations

Once started, grouting is to be continued until refusal criteria of 5 lugeon values is obtained. Injection will commence with low viscosity, then grout is to be thickened according to procedures to be submitted for approval to the Engineer.

- minimum viscosity 35 s measured with the Marsh cone
- maximum viscosity so measured with the Marsh cone.
- Grout having remained more than 2 hours in tanks, pumps or pipes shall be discarded.
- Grout temperature shall not exceed 35o C when injected.
- Grout flows from fractures or other sources shall be prevented or effectively dealt with.

5.12 Consolidation Grouting

The Contractor shall perform consolidation grouting of rock foundations along the Dam axis and elsewhere as shown on the Drawings or as directed by the Engineer, following placement of a layer of concrete (grout cap) over the foundations.

Consolidation grouting shall not be commenced until fifteen (7) days after placement of concrete in grout cap, or twenty eight (28) days for concrete in structures. Grout pressure shall be regulated to prevent uplifting of the concrete. The Contractor shall drill grout holes through the concrete or, with the approval of the Engineer, install grout pipes in position before placement of concrete to facilitate drilling and grouting.

The hole depths will vary up to 5 m, and the grouting pressures shall not exceed 0.2 N/mm2 depending on geological conditions. Grouting shall be commenced after conducting a water pressure test as prescribed in this specification. Grouting shall be performed in one stage with a packer or nipple installed within the concrete. However, if the geological conditions require, the grouting of holes shall be carried out in stages of 1 meter or more: Unless otherwise ordered by the Engineer, each hole to be grouted shall be thoroughly washed under pressure immediately before the injection. Washing shall be continued until the return water becomes clean.

Re-drilling and drilling for a subsequent stage shall not be permitted to start earlier than 12 hours after completion of the preceding stage to prevent washing out of grout.

Grouting shall be commenced with grout at a water : cement concentration of 4: 1 by weight, unless otherwise specified or directed by the Engineer. In accordance with changes in injection volume and pressure, the grout mix shall be progressively thickened to 3:1, 2:1, 1:1 and 0.6:1 as directed by the Engineer.

Grouting pressure will vary according to the geological condition, thickness of overburden, ground water head, planned internal water pressure and lining thickness, but will not exceed 3.0 N/mm2 except as specifically ordered by the Engineer.

The grouting of any hole shall be continued 30 minutes after the hole takes grout at a of less than 0.4 liters per minute per linear meter of the hole at the maximum pressure prescribed by the Engineer. After the grouting of the hole is completed the pressure shall be maintained by means of stopcocks or other suitable valves

If during the grouting of any hose, grout is found to flow from any part of the structure or the bedrock, such flow or leaks shall be immediately plugged or caulked by the Contractor.

5.12.1 Procedure For Contact And Consolidation Grouting

Contact and consolidation grouting holes shall be grouted in reverse procedure by complete horizontal rows, starting from upstream and downstream extremities of the line, progressing towards the center of the line.

Any communication between holes is observed; the seeping hole is first plugged until the end of the grouting under execution, then grouted in priority.

The maximum grouting pressure shall be within the range of 0.1 - 0.5 MPa. The Construction figure shall be determined by the Engineer. Grouting of any hole shall be considered as completed when at the refusal pressure; the rate of a grout is less than 2 l/mn per 5 m section during 2 successive periods of 5 minutes.

5.13 Quality control

5.13.1 Grout characteristics

During grouting operations, the Contractor shall perform the following checkings at the intervals mentioned:

- Once per day and per type of grout:
  a) Bleeding
  b) Viscosity
  c) Density
- Twice per month and per type of grout:
  a) Initial setting time
  b) Compressive strength at 28 days.

During the grouting. the Contractor shall control carefully and permanently the pressure and record every variation. or, Unplasticized polyvinyl chloride (uPVC) pipes and fittings shall comply with B53506. Class B.

Joints shall comply with BS4346-Part 1 They shall be supplied by an approved Manufacturer.

5.14 Fabrication

Concrete pipes shall be uniformly circular in section and thickness with a smooth hard surface free from all defects and shall above spigot and sockets or collar type joint unless specified by the Engineer.

5.15 Grouting Records

The Contractor shall maintain written or electronic records on approved proforma of all grouting operations. Records shall include, but not necessarily be limited to the following:

- Dates, times, locations and supervision
- Injection pressures records with time for each packer placement
- Rates of grout takes
- Mixes used

- Total consumption per packer placement and hole
- Surface leakages
- Connection of grout between holes

5.16 Measurement And Payment

5.16.1 Drilling

Measurement for payment for drilling holes for consolidation and curtain grouting will be made of the depth of holes drilled as shown in the drawings or as directed by the Engineer in rock or concrete. Re-drilling of hardened grout holes will not be included for measurement.

Where a steel stun pipe is embedded in concrete by the Contractor in lieu of drilling through concrete, the hole depth will be measured from the surface of the concrete. No payment will be made for the stub pipe.

Payment for drilling holes will be made at the respective unit rates per linear meter stated in Bill of Quantities which unit rates shall constitute full compensation for the cost of all labour, tools, equipment and materials for drilling through rock and /or concrete, re-drilling through hardened grout, protecting the holes until grouted and all other items necessary to complete the work.

5.16.2 Consolidation Grouting

Measurement for payment of consolidation grouting dam axis, spillway rock foundations and elsewhere will be made on the weight of cement injected into the holes as directed by the Engineer and determined by the detailed data verified from record sheets automatic level recorder or other means approved by the Engineer.

Payment for consolidation grouting will be made at the unit rates per ton for cement started in the Bill of Quantities, which unit rates shall constitute full compensation for the cost of all labour, tools, equipment and materials, furnishing, loading, hauling, unloading, storing, mixing, and injecting grouting materials, wastage of material , parker setting, water pressure testing, furnishing, installing, operating, maintaining and removal of automatic level recorder and other items necessary to complete the work

5.16.3 Curtain Grouting

Measurement for payment of Curtain grouting along the dam axis, rock foundations and elsewhere will be made on the weight of cement injected into the holes as directed by the Engineer and determined by the detailed data verified from record sheets automatic level recorder or other means approved by the Engineer.

Payment for Curtain grouting will be made at the unit rates per Kgs for cement stated in the Bill of Quantities, which unit rates shall constitute full compensation for the cost of all labour, tools, equipment and materials, furnishing, loading, hauling, unloading, storing, mixing, and injecting grouting materials, wastage of material , parker setting, , installing, operating, maintaining and removal of automatic level recorder and other items necessary to complete the work

5.16.4 Water Pressure Testing

No separate payment for water pressure testing will be made and the cost thereof shall be deemed to be included in the unit rates sated in the Bill of Quantities for various types of grouting items.

5.16.5 Test Holes

Where directed by the Engineer, the Contractor shall drill test holes and recover core samples to investigate geological conditions, or for investigating the effectiveness of grouting operations.

All test drilling shall be performed with rotary drilling equipment using coring type bits in accordance with equipment section of this specification. Holes shall be drilled at any angle and to depths as directed by the Engineer.

The Contractor shall keep a driller's log available to the Engineer, of each hole drilled, on which shall be recorded coordinates, location, elevation and final depth of the hole, the nature of the rock drilled and other pertinent data usually recorded in logs of drill holes, such as core recovery percentages, R.Q.D., etc.

Core samples shall be placed in suitable wooden boxes with hinged covers to be furnished by the Contractor. The core samples in each run shall be separated in the box by a divider and shall be identified by means of a wooden tag inserted at the end of the run, upon which the depth of the run shall be marked. All core boxes shall be clearly marked with the number of the hole from which the core was taken and the date of drilling. After core inspection and logging work have been completed, these core boxes shall be delivered by the Contractor to the place of storage at the project site as designated by the Engineer.

Test holes may be grouted under pressure if conditions so indicate, and in such cases the holes shall be grouted to full depth in one operation. Measurement and payment for grouting will be made in accordance with Section 3.16.1, Consolidation Grouting.

Any test hole in the headrace tunnel which is not required to be grouted shall be packed to the full depth of the concrete lining with tightly rammed dry mortar.

Measurement for payment for drilling test holes will be made of the length of holes drilled as directed by the Engineer.

Payment for test hole drilling will be made at the unit rate per linear meter stated in the Bill of Quantities, which rate shall constitute full compensation for the cost of all labour, tools, equipment and materials for drilling through rock and/or concrete, recovering core samples with core boxes, and all other items necessary to complete the works.

5.16.6 Permeability Test

The Contractor shall execute permeability test in the test hole by stage of less than 5 meters.

Prior to commencement of grouting in each stage, a permeability test shall be done for the purpose of assessing to rock condition. A packer shall be set tightly at the top of the stage to be tested and clean water shall be pumped into the hole under constant pressure that is so controlled by handling the return line valve. Injection of water shall be continued at least 10 minutes for each pressure of 0.5 N/mm2, 1.0 N/mm2, 1.5 N/mm2, 2.0 N/mm2, 1.0 N/mm2, 0.5 N/mm2, after the injection rate become stable.

The Contractor shall record all necessary data of the test such as the hole number, the stage, the ground water level, the pressures, the injection rates and the height of pressure gauge from the neck of the hole.

The pressure to be applied shall be directed by the Engineer and shall not exceed 80% of maximum allowable pressure for the stage in grouting, unless otherwise directed by the Engineer.

Measurement for payment of permeability tests shall be made, on the basis of actual tested times, in times determined by the detailed data as approved by the Engineer.

Payment shall be made for the number of times measured as provided above at the respective unit rates per time stated in the Bill of Quantities, which unit rates for permeability tests shall constitute full compensation for the cost of all labour, tools, equipment, and materials including furnishing, loading, hauling, unloading, stacking and all incidental items necessary to complete the work.

6. CONCRETE WORKS

6.1 General

All materials and workmanship for concrete shall comply with BS 8110 and BS 8007 where applicable.

This section covers the materials, design of mixes, mixing, transport, placing, compaction and curing of concrete and mortar required in the works. It also covers formwork and reinforcement for concrete.

6.2 Definitions

Structural concrete is any class of concrete which is used in reinforced, prestressed or unreinforced concrete construction, which is subject to stress.

Non-structural concrete is composed of materials complying with the Specification but for which no strength requirements are specified and which is used only for filling voids, blinding foundations and similar purposes where it is not subjected to significant stress.

A **formed surface** is a face which has been cast against formwork.

An **unformed surface** is a horizontal or nearly horizontal surface produced by screeding or trowelling to the level and finish required.

A **pour** refers to the operation of placing concrete into any mould, bay or formwork, etc, and also to the volume which has to be filled. Pours in vertical succession are referred to as lifts.

6.3 Materials For Concrete

6.3.1 (a) General

The Contractor shall submit to the Engineer full details of all materials which he proposes to use for making concrete. No concrete shall be placed in the works until the Engineer has approved the materials of which it is composed. Approved materials shall not thereafter be altered or substituted by other materials without the consent of the Engineer.

6.3.2 (b) Cement

Cement shall comply with the following Kenya Standards:-

- KS1725:2001 CEM 1 42.5N for Ordinary Portland Cement.
- KS02-21 for Rapid Hardening Portland Cement plus all special conditions to its use stipulated by the manufacturer

Cement shall be free flowing and free of lumps. It shall be supplied in the manufacturer's sealed unbroken bags or in bulk. Bagged cement shall be transported in vehicles provided with effective means of ensuring that it is protected from the weather.

Bulk Cement shall be transported in vehicles or in containers built and equipped for the purpose.

Cement in bags shall be stored in a suitable weatherproof structure of which the interior shall be dry and well ventilated at all times. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through it.

Each delivery of cement in bags shall be stacked together in one place. The bags shall be closely stacked so as to reduce air circulation but shall not be stacked against an outside wall. If pallets are used, they shall be constructed so that bags are not damaged during handling and stacking. No stack of cement bags shall exceed 3 m in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks.

Cement from broken bags shall not be used in the Works.

Cement in bags shall be used in the order in which it is delivered.

Bulk cement shall be stored in weatherproof silos which shall bear a clear indication of the type of cement contained in them. Different types of cement shall not be mixed in the same silo.

The Contractor shall provide sufficient storage capacity on site to ensure that his anticipated programme or work is not interrupted due to lack of cement.

Cement which has become hardened or lumpy or fails to comply with the Specification in any way shall be removed from the Site.

All cement for any one structure shall be from the same source.

All cement used in the works shall be tested by the manufacturer or the Contractor in a laboratory acceptable to the Engineer. The tests to be performed shall be those set out in Section 2 of this Specification and the Contractor shall supply two copies of each certificate to the Engineer.

Each set of tests carried out by the manufacturer or Contractor shall relate to not more than one day's output of each cement plant, and shall be made on samples taken from cement which is subsequently delivered to the Site. Alternatively, subject to the agreement of the Engineer, the frequency of testing shall be one set of tests for every 200 tonnes of cement delivered to Site from each cement plant.

Cement which is stored on Site for longer than one month shall be re-tested in the laboratory of the Materials Branch of the Ministry of Transport and Communications or at the Kenya Bureau of Standards at the rate instructed by the Engineer.

Cement which does not comply with the Specification shall not be used in Works and it shall be disposed of by the Contractor.

The Contractor shall keep full records of all data relevant to the manufacture, delivery, testing and use of all cement used in the Works and shall provide the Engineer with two copies thereof.

6.3.3 (c) Fine aggregate

Fine aggregate shall be clean hard and durable and shall be natural sand, crushed gravel sand or crushed rock sand complying with BS 882. All the material shall pass through a 5 mm BS sieve and the grading shall be in accordance with Zones 1, 2 or 3 of BS 892. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source. Fine aggregate for mortar only shall comply with BS 1200.

The fine aggregate shall not contain iron pyrites or iron oxides. It shall not contain mica, shale, coal or other laminar, soft or porous materials or organic matter unless the Contractor can show by comparative tests, on finished concrete as set out in BS

1891, that the presence of such materials does not adversely affect the properties of the concrete.

Other properties shall be as set out below:

Content passing a 75 micron BS sieve shall not exceed 3 per cent for natural or crushed gravel sand or 15 per cent for crushed rock sand.

Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.05 per cent by weight expressed as chloride ion when tested as set out in BS 812, subject also to the further restriction given in the note on total chloride content in Sub-Clause 5.3 (d).

Sulphates soluble in a 10 per cent solution by weight of hydrochloric acid shall not exceed 0.4 per cent by weight expressed as SO3, when tested as set out in BS 1377, subject also to the further restriction given in the note on total sulphate content in Sub-Clause 5.4 (d).

Soundness: After five cycles of the test in AASHTO T104 the aggregate shall not show a weight loss of more than 10 per cent.

Organic impurities: If the test described in Section 2 of this standard Specification shows that more than a trace of organic impurities is present, the fine aggregate shall not be used in the Works unless the Contractor can show by tests on finished concrete as set out in BS 1881 that the presence of organic impurities does not adversely affect the properties of the concrete.

6.3.4 (d) Coarse Aggregate

Coarse aggregate shall be clean hard and durable crushed rock, crushed gravel or natural gravel complying with the requirements of BS 882. The material shall not contain any iron pyrites, iron oxides, flaky or laminated material, hollow shells, coal or other soft or porous material, or organic matter unless the contractor can show by comparative tests on finished concrete as set out in BS 1881 that the presence of such material does not adversely affect the properties of the concrete. The pieces shall be angular rounded or irregular as defined in BS 812 Part 1.

Coarse aggregate shall be supplied in the nominal sizes called for in the contract and shall be graded in accordance with BS 882 for each nominal size.

Other properties shall be as set out below: -

The proportion of clay, silt and other impurities passing a 75 micron BS sieve shall be not more than one per cent by weight.

The content of hollow and flat shells shall not be such as will adversely affect the concrete quality when tested as set pout in BS 1881. The total shell content of aggregate shall not be more than the following:

40 mm nominal size and above	2% of dry weight
20 mm nominal size	5% of dry weight
10 mm nominal size	15% of dry weight

Chlorides soluble in a 10 per cent solution by weight of nitric acid shall not exceed 0.03 per cent by weight, expressed as chloride ion when tested as set out in BS 812

but subject also to the further restriction under the note on total chloride content hereunder. Sulphates soluble in a 10 per cent solution by weight of hydrochloric acid shall not exceed 0.4 per cent by weight expressed as SO3 when tested as set out in BS 1377 subject also to the further restriction given in the note on total sulphate content hereunder.

Soundness: After 5 cycles of the test in AASHTO T104, the aggregate shall not show a weight loss of more than 12 per cent.

When tested in accordance with test C289 of the American Society for Testing and Materials, the aggregate shall be non-reactive.

Flakiness Index when tested in accordance with BS 812 shall be as set out hereunder:-

For 40 mm stone and above, not more than 40

For 20 mm stone and below, not more than 35

6.3.5 (e) Testing aggregates

(i) Acceptance testing

The Contractor shall deliver to the Engineer samples containing not less than 50 kg of any aggregate which he proposes to use in the Works and shall supply such further samples as the Engineer may require. Each sample shall be clearly labeled to show its origin and shall be accompanied by all the information called for in BS 882.

Tests to determine compliance of the aggregates with the requirements of Sub-Clause 5.4 (c) and (d) shall be carried out by the Contractor in a laboratory acceptable to the Engineer. If the tested materials fail to comply with the Specification, further tests shall be made in the presence of the Contractor and the Engineer and acceptance of the material shall be based on such tests.

A material shall be accepted if not less than three consecutive sets of test results show compliance with the Specification.

(ii) Compliance testing

The Contractor shall carry out routine testing of aggregates for compliance with the Specification during the period that concrete is being produced for the Works. The tests set out below shall be performed on aggregates from each separate source on the basis of one set of tests for each day on which aggregates are delivered to Site provided that no set of tests shall represent more than 250 tonnes of fine aggregate nor more than 500 tonnes of coarse aggregate, and provided also that the aggregates are of uniform quality. If the aggregate from any source is variable, the frequency of testing shall be increased as instructed by the Engineer.

Grading	BS 812
Silt and clay contents	BS 812
Moisture content	BS 812
Check on organic impurities	As directed by the Engineer

In addition to the above routine tests, the Contractor shall carry out the following tests at the frequencies stated:

(i) Moisture content; as frequently as may be required in order to control the water content of the concrete as required by the Specification.

(ii) Chloride content: as frequently as may be required to ensure that the proportion of chlorides in the aggregates does not exceed the limit stated in the Specification.

The Contractor shall take account of the fact that when the chloride content is variable it may be necessary to test every load in order to prevent excessive amounts of the chloride contaminating the concrete. For this purpose the Contractor shall use the rapid field test (Quantab test). In the event of disagreement regarding the results of the field test, the chloride content of the aggregate shall be determined in the laboratory as described in BS 812 (Volhard test).

6.3.6 (f) Delivery and storage of aggregates

Aggregates shall be delivered to Site in clean and suitable vehicles. Different types or sizes of aggregate shall not be delivered in one vehicle.

Each type or size of aggregate shall be stored in a separate bin or compartment having a base such that the contamination of aggregate is prevented. Dividing walls between bins shall be substantial and continuous so that no mixing of types or sizes occurs.

The storage of aggregates shall be arranged so that as far as possible rapid drying out in hot weather is prevented in order to avoid sudden fluctuations in water content. Storage of fine aggregates shall be arranged so that they can drain sufficiently before use in order to prevent fluctuations in water content of the concrete.

6.3.7 (g)Water for concrete and mortar

Seawater or brackish water containing more than 1000 ppm chloride ion or 2000 ppm sulphate ion shall not be used for mixing or curing concrete.

Water shall be cleanand free from harmful matter and comply with the requirements of BS 3149.

The Contractor shall carry out tests in accordance with BS 3148 to establish compliance with the Specification.

6.3.8 (h) Admixtures

(i) General

The use of the admixtures in concrete may be required under the Contract to promote special properties in the finished concrete or may be proposed by the Contractor to assist him in compliance with the Specification.

In all cases the Contractor shall submit to the Engineer full details of the admixture he proposes to use and the manner in which he proposes to add it to the mix. The information provided shall include:-

(a) The typical dosage, the method of dosing and the detrimental effects of an excess or deficiency in the dosage.

(b) The chemical names of the main active ingredients in the admixture.

(c) Whether or not the admixture contains chlorides, and if so the chloride ion content expressed as a Percentage by weight of admixture.

(d) Whether the admixture leads to the entrainment of air when used at the manufacturer's recommended dosage and if so, the extent to which it does so.

(e) Details of previous uses of the admixture in Kenya.

The chloride ion content of any admixture shall not exceed 2 per cent by weight of the admixture nor 0.03 per cent by weight of the cement in the mix.

Admixtures shall not be mixed together without the consent of the Engineer.

Calcium chloride or admixtures containing calcium chloride shall not be used in prestressed concrete.

(ii) Workability agents

Workability agents shall comply with BS 5075 and shall not have any adverse affect on the properties of the concrete.

6.4 The Design Of Concrete Mixes

6.4.1 (a) Classes of concrete

The classes of structural concrete to be used in the Works shall be those shown on the Drawings and designated in Table 5-1, in which the class designation includes two figures. The first figure is the nominal strength at 28 days expressed in N/mm^2 and the second figure is the maximum nominal size of aggregate in the mix expressed in millimeters.

TABLE 5-l Concrete Classes and Strengths

Class of concrete	Nominal strength N/m^2	Maximum Nominal Size of aggregate mm	Maximum water/cement ratio		Trial mixes Target Mean Strength (clause 5.4.3(c)) N/mm^2	Early works test cubes (clause 5.4.4(d))	
			A	B		Any one cube N/mm^2	Average of any group of 4 cubes N/mm^2
10/75	10	75	0.60	0.55	13.5	9.5	13.3
15/75	15	75	0.60	0.50	21.5	12.8	20.0
15/40	15	40	0.60	0.50	21.5	12.8	20.0
15/20	15	20	0.57	0.50	21.5	12.8	20.0
20/40	20	40	0.57	0.48	31.5	17.0	27.5
20/20	20	20	0.55	0.48	31.5	17.0	27.5

20/10	20	10	0.53	0.48	31.5	17.0	27.5
25/40	25	40	0.50	0.46	36.5	21.3	32.5
25/20	25	20	0.52	0.46	36.5	21.3	32.5
25/10	25	10	0.50	0.46	36.5	21.3	32.5
30/40	30	40	0.48	0.45	41.5	25.5	37.5
30/20	30	20	0.48	0.45	41.5	25.5	37.5
30/10	30	10	0.47	0.45	41.5	25.5	37.5
40/20	40	20	0.46	0.43	51.5	34.0	47.5
40/10	40	10	0.45	0.43	51.5	34.0	47.5

NOTE: Under water/cement ratio, column A applies to moderate and intermediate exposure, and column B applies to severe exposure. See NOTE after Table 5-2.

6.4.2 (b) Design of proposed mixes

The contractor shall design all the concrete mixes called for on the Drawings, making use of the ingredients which have been approved by the Engineer for use in the works and in compliance with the following requirements:-

(i) The aggregate portion shall be well graded from the nominal maximum size of stone down to the 150 micron size.

(iii) The cement content shall be such as to achieve the strengths called for in Table 5-1 but in any case not less than the minimum necessary for impermeability and durability shown in Table 5-2.

(iii) The workability shall be consistent with ease of placing and proper compaction having regard to the presence of reinforcement and other obstructions.

(iv) The water/cement ratio shall be the minimum consistent with adequate workability but in any case not greater than that shown in Table 5-1 taking due account of any water contained in the aggregates. The Contractor shall take into account that this requirement may in certain cases require the inclusion of a workability agent in the mix.

(v) The drying shrinkage determined in accordance with BS 1881 shall not be greater than 0.05 per cent.

Table 5-2 Minimum Cement Content

Class of Concrete	Minimum Cement Content - Kg/ m3 of Compacted concrete		
	Moderate Exposure	Intermediate Exposure	Severe Exposure

10/75; 15/75	200	220	270
15/40, 20/40, 25/40, 30/40	240	270	290
15/20, 20/20, 25/20, 30/20	260	300	330
40/20	300	320	330
20/10, 25/10, 30/10	300	340	390
40/10	310	340	390

NOTE: the minimum cement contents shown in the above table are required in order to achieve impermeability and durability. In order to meet the strength requirements in the Specification higher contents may be required.

The categories applicable to the Works are based broadly on the factors listed hereunder:

Moderate exposure	Surface sheltered from severe rain; buried concrete, concrete continuously under water
Intermediate exposure	Surface exposed to driving rain; alternate wetting and drying; traffic; corrosive fumes; heavy condensation.
Severe exposure	Surface exposed to sea water, moorland water having a pH of 4.5 or less, Groundwater containing sulphates.

6.4.3 (c) Trial mixes

At least six weeks before commencing placement of concrete in the Permanent works trial mixes shall be prepared for each class of concrete specified·

For each mix of concrete for which the Contractor has proposed a design, he shall prepare three separate batches of concrete using the materials which have been approved for use in the Works and the mixing plant which he proposes to use for the works. The volume of each batch shall be the capacity of the concrete mixer proposed for full production.

Samples shall be taken from each batch and the following action taken, all in accordance with BS 1881:-

(i) The slump of the concrete shall be determined.

(ii) Six test cubes shall be cast from each batch. In the case of concrete having a maximum aggregate size of 40 mm or less, 150 mm cubes shall be used. In the case of concrete containing 75 mm or larger aggregate, 200 mm cubes shall be used and in addition any pieces of aggregate retained on a 53 mm BS sieve shall be removed from the mixed concrete before casting the cubes.

(iii) Three cubes from each batch shall be tested for compressive strength at seven days and the remaining three at 28 days.

(iv) The density of all the cubes shall be determined before the strength tests are carried out.

Subject to the agreement of the Engineer, the compacting factor apparatus may be used in place of a slump cone. In this case the correlation between slump and compacting factor shall be established during preparation of the trail mixes.

The average strength of the nine cubes tested at 28 days shall be not less than the target mean strength shown in Table 5-1.

The Contractor shall also carry out tests to determine the drying shrinkage of the concrete unless otherwise the directed by the Engineer.

Based on the results of the tests on the trial mixes, the Contractor shall submit full details of his proposals for mix design to the Engineer, including the type and source of each ingredient, the proposed proportions of each mix and the results of the tests on the trial mixes.

If the Engineer does not agree to a proposed concrete mix for any reason, the Contractor shall amend his proposals and carry out further trial mixes. No mix shall be used in the works without the written consent of the Engineer.

6.4.4 (d) Quality control of concrete production

(i) Sampling

For each class of concrete in production at each plant for use in the works, samples of concrete shall be taken at the point of mixing and/or of deposition as instructed by the Engineer, all in accordance with the sampling procedures described in BS l88l and with the further requirements set out below.

Six 150 mm or 200 mm cubes as appropriate shall be made from each sample and shall be cured and tested all in accordance with BS 1881, two at seven days and the other four at 28 days.

Each sample shall be taken from one batch selected at random and at intervals such that each sample represents not more than 20 m^3 of concrete unless the Engineer agrees to sampling at less frequent intervals.

Until compliance with the Specification has been established the frequency of sampling shall be three times that stated above or such lower frequency as may be instructed by the Engineer.

(ii) (ii) Testing

(a) The slump or compacting factor of the concrete shall be determined for each batch from which samples are taken and in addition for other batches at the frequency instructed by the Engineer.

The slump of the concrete in any batch shall not differ from the value established by the trial mixes by more than 25 mm or one third of the value, whichever is the greater.

The variation in value of the compacting factor, if used in place of a slump value, shall be within the following limits:

For value of 0.9 or more	± 0.03

For value of between 0.8 and 0.9	± 0.04
For values of 0.8 or less	± 0.05

(b) The water/cement ratio as estimated from the results of (a) above, determined by samples from any batch shall not vary by more than five per cent from the value established during the trial mixes.

(c) The air content of air entrained concrete in any batch shall be within l.5 units of the required value and the average value of four consecutive measurements shall be within 1.0 unit of the required value, expressed as a percentage of the volume of freshly mixed concrete.

(d) Until such time as sufficient test results are available to apply the method of control described in (e) below, the compressive strength of the concrete at 28 days shall be such that no single result is less than the value shown in Table 5-1 under the heading 'early works test cubes' and also that the average value of any four consecutive results is not less than the value shown in Table 5-l under the same heading.

The 7-day cube result may be used as an early strength indicator, at the discretion of the Engineer.

(e) When test cube results are available for at least 20 consecutive batches of any class of concrete mixed in any one plant, the average of any four consecutive results at 28 days shall exceed the nominal strength by not less than half the current margin (see table below) and each individual result shall not be less than 85 per cent of the nominal strength.
The current margin shall be defined as 1.64 times the standard deviation of cube tests on at least 20 separate consecutive batches produced from one plant over a period exceeding five days but not exceeding six months or on at least 50 separate consecutive batches produced from one plant over a period not exceeding 12 months. If both figures are available, the smaller shall be taken.

The current margin shall in any case at be less than the figure given below:-

	Minimum current margin for		
	10N/mm^2	l5N/mm^2	20N/ mm^2 and above
After 20 batches	3.3	5	7.5
After 50 batches	1.7	2.5	3.8

(f) Failure to comply with requirements

If any one test cube result in a group of four consecutive results is less than 85 per cent of the nominal strength but the average of the group of which it is part satisfies the strength requirement, then only the batch from which the failed cube was taken shall be deemed not to comply with the Specification.

If more than one cube result in a group of four consecutive results is less than 85 per cent of the nominal strength or if the average strength of the group of

which it is part fails to satisfy the strength requirement then all the batches between those represented by the first and last cubes in the group shall be deemed not to comply with the Specification, and the Contractor shall immediately adjust the mix design subject to the agreement of the Engineer to restore compliance with the Specification.

After adjustment of the mix design the Contractor will again be required to comply with sub-(clauses 5.4 (b) and 5.4 (c) of this Section of this Specification.

The Contractor shall take necessary action to remedy concrete which does not comply with this Specification. Such action may include but is not necessarily confined to the following:-

(i) Increasing the frequency of sampling until control is again established.

(ii) Cutting test cores from the concrete and testing in accordance with BS 1881.

(iii) carrying out strengthening or other remedial work to the concrete where possible or appropriate.

(iv) carrying out non destructive testing such as load tests on beams

(v) removing the concrete

6.5 Mixing Concrete

Before any plant for batching, mixing, transporting, placing, compacting and finishing concrete is ordered or delivered to site, the Contractor shall submit to the Engineer full details including drawings of all the plant which he proposes to use and arrangements he proposes to make.

Concrete for the works shall be batched and mixed in one or more central plants unless the Engineer agrees to some other arrangement. If the Contractor proposes to use ready mixed concrete he shall submit to the Engineer for his approval full details and test results of the concrete mixes. The Engineer may approve the use of ready mixed concrete provided that:

a. The proposed mixes, the material to be used and the method of storage and mixing comply with the requirements of the specification; and

b. Adequate control is exercised during mixing.

Approval to the use of ready mixed concrete may be withdrawn is the Engineer is not satisfied with the control of the materials being used and control during mixing.

Batching and mixing plants shall be modern efficient equipment complying with the requirements of BS 1305 and capable of producing a uniform distribution of the ingredients throughout the mass. Truck mixes shall comply with the requirements of BS 4251 and shall only be used with prior arrangement with the engineer. If the plant proposed by the contractor does not fall within the scope of BS1305, it shall have been tested in accordance with BS 3963 and shall have a mixing performance within the limits of Table 6 of BS 1305.

All mixing operations shall be under the control of an experienced supervisor.

The aggregate storage bins shall be provided with drainage facilities arranged so that drainage water is not discharged to the weigh hoppers. Each bin shall be drawn done at least once per week and any accumulations of mud or silt removed.

Cement and aggregates shall be batched by weight. Water may be measured by weight or volume.

The weighing and water dispensing mechanisms shall be maintained in good order. Their accuracy shall be maintained within the tolerances described in BS 1305 and checked against accurate weights and volumes when required by the Engineer.

The weights of cement and of each size of aggregate as indicated by the mechanisms employed shall be within a tolerance of plus or minus two per cent of the respective weight per batch agreed by the Engineer.

The Contractor shall provide standard test weights at least equivalent to the maximum working load used on the most heavily loaded scale and other auxiliary equipment required for checking the satisfactory operation of each scale or other measuring device. Tests shall be made by the Contractor at least once a week or at intervals to be determined by the Engineer and shall be carried out in his presence. For the purpose of carrying out these tests, there shall be easy access for personnel to the weigh hoppers. The Contractor shall furnish the Engineer with copies of the complete results of all check tests and shall make any adjustments, repairs or replacements necessary to ensure satisfactory performance.

The nominal drum or pan capacity of the mixer shall not be exceeded. The turning speed and the mixing time shall be as recommended by the manufacturer, but in addition, when water is the last ingredient to be added, mixing shall continue for at least one minute after all the water has been added to the drum or pan.

The blades of pan mixers shall be maintained within the tolerances specified by the manufacturer of the mixer and the blades shall be replaced when it is no longer possible to maintain the tolerances by adjustment.

Mixers shall be fitted with an automatic recorder registering the number of batches discharged.

The water to be added to the mix shall be reduced by the amount of free water contained in the coarse and fine aggregates. This amount shall be determined by the Contractor by a method agreed by the Engineer immediately before mixing begins each day and thereafter at least once per hour during concreting and for each delivery of aggregates during concreting. When the correct quantity of water, determined as set out in the Specification, has been added to the mix, no further water shall be added, either during mixing or subsequently.

After mixing for the required time, each batch shall be discharged completely from the mixer before any materials for the succeeding batch are introduced.

Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed and thereafter the first batch of concrete through the mixers shall contain only half the normal quantity of coarse aggregate. This batch shall be mixed for one minute longer than the time applicable to a normal batch.

Mixers shall be cleaned out before changing to another type of cement.

6.6 Hand Mixed Concrete

Concrete for structural purposes shall not be mixed by hand. Where non-structural concrete is required, hand mixing may be carried out subject to the agreement of the Engineer.

The mixing shall be done on a hard impermeable surface. The materials shall be turned over not less than three times dry, water shall then be sprayed on and the materials again turned over not less than three times in a wet condition and worked together until a mixture of uniform consistency is obtained.

For band mixed concrete the specified quantities of cement shall be increased by 10% and not more than 0.5 cubic metres shall be mixed at one time. During windy weather efficient precautions shall be taken to prevent cement from being blown away during the process of gauging and mixing.

6.7 Transport Of Concrete

The concrete shall be discharged from the mixer and transported to the Works by means which shall prevent adulteration, segregation or loss of ingredients, and which shall ensure that the concrete is of the required workability at the point and time of placing. The loss of slump between discharge from the mixer and placing shall not exceed 25 mm.

The time elapsing between mixing and placing a batch of concrete shall be as short as practicable as and in any case not longer than will permit completion of placing and compaction before the onset of initial set. If the placing of any batch of concrete is delayed beyond this period, the concrete shall not be placed in the Works.

6.8 Placing Of Concrete

6.8.1 (a) Consent for placing

Concrete shall not be placed in any part of the Works until the Engineer's consent has been given in writing, and the contractor shall give the Engineer at least 1 full working days notice of his intention to place concrete.

If concrete placing is not commenced within 24 hours of the Engineer’s consent the Contractor shall again request consent as specified above.

6.8.2 (b) Preparation of surface to receive concrete

Excavated surfaces on which concrete is to be deposited shall be prepared as set out in Section 4 of this Specification.

Existing concrete surfaces shall be prepared as set out in (clause 5.19. Before deposition of further concrete they shall be clean, hard and sound and shall be wet but without any free-standing water.

Any flow of water into an excavation shall be diverted through proper side drains to a sump, or be removed by other suitable methods which will prevent washing away the freshly deposited concrete or any of its constituents. Any underdrains constructed for this purpose shall be completely grouted up when they are no longer required by a method agreed by the Engineer.

Unless otherwise instructed by the Engineer surfaces against which concrete is to be placed shall receive a prior coating or mortar mixed in the proportions similar to those of the fines portion in the concrete to be placed. The mortar shall be kept

ahead of the concrete. The mortar shall be well worked into all parts of the excavated surface and shall be not less than 5 mm thick.

If any fissures have been cleaned out as described in Section 4 of this Specification they shall he filled with mortar or with concrete as instructed by the Engineer.

The amount of mortar placed at any one time shall be limited so that it does not dry out or set before being covered with concrete.

6.8.3 (c) Placing procedures

The concrete shall be deposited as nearly as possible in its final position. It shall be placed so as to avoid segregation of the concrete and displacement of the reinforcement, other embedded items, or formwork. It shall be brought up in layers approximately parallel to the construction joint planes and not exceeding 500 mm in compacted thickness unless otherwise permitted or directed by the Engineer, but the layers shall not be thinner than four times the maximum nominal size of aggregate.

Layers shall not be placed so that they form feather edges nor shall they be placed on a previous layer which has taken its initial set. In order to comply with this requirement, a layer may be started before completion of the preceding layer.

All the concrete in a single bay or pour shall be placed as a continuous operation. It shall be carefully worked round all obstructions, irregularities in the foundations and the like so that all parts are completely full of compacted concrete with no segregation or honeycombing. It shall also be carefully worked round and between waterstops, reinforcement, embedded steelwork and similar items which protrude above the surface of the completed pour.

All work shall be completed on each batch of concrete before its initial set commences and thereafter the concrete shall not be disturbed before it has set hard. No concrete that has partially hardened during transit shall be used in the Works and the transport of concrete from the mixer to the point of placing shall be such that this requirement can be complied with.

Concrete shall not be placed during rain which is sufficiently heavy or prolonged to wash mortar from coarse aggregate on the exposed faces of fresh concrete. Means shall be provided to remove any water accumulating on the surface of the placed concrete. Concrete shall not be deposited into such accumulations of water.

In dry weather, covers shall be provided for all fresh concrete surfaces which are not being worked on. Water shall not be added to concrete for any reason.

When concrete is discharged above its place of final deposition, segregation shall be prevented by the use of chutes, downpipes, trunking, baffles or other appropriate devices.

Forms for walls, columns and other than sections of significant height shall be provided with openings or other devices that will permit the concrete to be placed in a manner that will prevent segregation and accumulations of hardened concrete on the formwork or reinforcement above the level of the placed concrete.

When it is necessary to place concrete under water the contractor shall submit to the Engineer his proposals for the method and equipment to be employed. The concrete shall be deposited either by bottom-discharging watertight containers or through funnel-shaped tremies which are kept continuously full with concrete up to

a level above the water and which shall have the discharging bottom fitted with a trapdoor and immersed in the concrete in order to reduce to a minimum the contact of the concrete with the water. Special care shall be taken to avoid segregation.

If the level of concrete in a tremie pipe is allowed to fall to such an extent that water enters the pipe, the latter shall be removed from the pour and filled with concrete before being again lowered into the placing position.

During and after concreting under water, pumping or de-watering in the immediate vicinity shall be suspended if there is any danger that such work will disturb the freshly placed concrete.

6.8.4 (d) Interruptions to placing

If concrete placing is interrupted for any reason and the duration of the interruption cannot be forecast or is likely to be prolonged, the Contractor shall immediately take the necessary action to form a construction joint so as to eliminate as far as possible feather edges and sloping top surfaces and shall thoroughly compact the concrete already placed in accordance with (Clause 5.09. All work on the concrete shall be completed while it is still plastic and it shall not thereafter be disturbed until it is hard enough to resist damage. Plant and materials to comply with this requirement shall be readily available at all times during concrete placing.

Before concreting is resumed after such an interruption the Contractor shall cut out and remove all damaged or uncompacted concrete, feather edges or any other undesirable features and shall leave a clean sound surface against which the fresh concrete may be placed.

If it becomes possible to resume concrete placing without contravening the Specification and the Engineer consents to resumption, the new concrete shall be thoroughly worked in and compacted against the existing concrete so as to eliminate any cold joints.

6.8.5 (e) Dimensions of pours

Unless otherwise agreed by the Engineer, pours shall not be more than two metres high and shall as far as possible have a uniform thickness over the plan area of the pour. Concrete shall be placed to the full planned height of all pours except in the circumstances described in Sub-(clause 5.8 (d).

The Contractor shall plan the dimensions and sequence of pours in such a way that cracking of the concrete does not take place due to thermal or shrinkage stresses.

6.8.6 (f) Placing sequence

The Contractor shall arrange that as far as possible the intervals between placing successive. Lifts of concrete in one section of the Works are of equal duration. This duration shall normally be not less than three or more than seven days under temperate weather conditions unless otherwise agreed by the Engineer.

Where required by the Engineer to limit the opening of construction joints due to shrinkage, concrete shall not be placed against adjacent concrete which is less than 21 days old.

When the drawings call for contraction gaps in concrete, these shall be of the widths and in the locations shown on the Drawings and they shall not be filled until the full time interval shown on the Drawings has elapsed.

6.9 Compaction Of Concrete

The concrete shall be fully compacted throughout the full extent of the placed layer. It shall be thoroughly worked against the formwork and around any reinforcement and other embedded items, without displacing them. Particular care shall be taken at arises and other confined spaces. Successive layers of the same pour shall be thoroughly worked together.

Concrete shall be compacted with the assistance if mechanical immersion vibrators, unless the Engineer agrees another method.

Immersion vibrators shall operate at the frequency of between 7,000 and 10,000 cycles per minute. The contractor shall ensure that vibrators are operated at beginning pressures and voltages not less than those recommended by the manufacturer in order that the compactive effort is not reduced.

A sufficient number of vibrators shall be operated to the entire quantity of concrete being placed to be vibrated for the necessary period and, in addition stand-by vibrators shall be available for instant use at each place where concrete is being placed.

Where the concrete contains aggregate with a nominal size of 75mm or more, vibrators with a diameter of 100 mm or more shall be used.

Vibration shall be continued at each point until, the concrete ceases to contract, a thin layer of mortar has appeared on the surface and air bubbles have ceases to appear. Vibrators shall not be used to move concrete laterally and shall be withdrawn slowly to prevent the formation of voids.

Vibration shall not be applied by way of reinforcement nor shall vibrators be allowed to touch reinforcement or other embedded items. The vibrators shall be inserted vertically into the concrete to penetrate the layer underneath at regular spacing which shall not exceed the distance from the vibrator over which vibration is visibly effective.

6.10 Curing Of Concrete

(a) General

Concrete shall be protected during the first stage of hardening from loss of moisture and from the development of temperature differentials within the concrete sufficient to cause cracking. The methods used of curing shall not cause damage of any kind to the concrete.

Curing shall be continued for as long as may be necessary to achieve the above objectives but in any case for at least seven days or until the concrete is covered by later construction whichever is the shorter period.

The above objectives are dealt with in sub-(clauses 5.11 (b) and (c) but nothing shall prevent both objectives being achieved by a single method where circumstances permit.

The curing process shall commence as soon as the concrete is hard enough to resist damage from the process, and in the case of large areas or continuous pours, shall commence on the completed section of the pour before the rest of the pour is finished.

Details of the Contractor's proposals for curing concrete shall be submitted to the Engineer before the placing of concrete Commences in the Works.

(b) Loss of moisture

Exposed concrete surfaces shall be closely covered with impermeable sheeting, properly secured to prevent its removal by wind and the development of air spaces beneath it. Joints in the sheeting shall be lapped by at least 300 mm.

If for some reason it is not possible to use impermeable sheeting, the Contractor shall keep the exposed surfaces continuously wet by means of a water spray or by covering with a water absorbent material which is kept wet, unless this method conflicts with sub-clause 5.11 (c).

Water used for curing shall be of the same quality as that used for mixing as stated in sub-(clause 5.4 (g).

Formed surfaces may be cured by retaining the formwork in place for the required curing period.

If the use of the foregoing methods is inappropriate, surfaces which will not have further concrete bonded to them and which are not to receive an application of a finish may be cured by the application of a curing compound having an efficiency index of at least 90 per cent. Curing compounds shall contain a fugitive dye to enable the extent of the spread to be seen easily.

Curing compound used on surfaces exposed to the sky shall contain sufficient finely divided flake aluminum in suspension to produce a complete coverage of the surface with a metallic finish when applied at the rate recommended by the manufacturer.

Curing compounds shall become stable and impervious to the evaporation of water from the concrete surface within 60 minutes of ·application. The material shall not react chemically with the concrete and shall not crack, peel or disintegrate within three weeks after application.

If instructed by the Engineer, the Contractor shall, in addition to the curing provisions set out above provide a suitable form of shading to prevent the direct rays of the sun reaching the concrete surfaces for at least the first four days of the curing period.

(c) Limitation of temperature differentials

The Contractor shall limit the development of temperate differentials in concrete after placing by any means appropriate to the circumstances including the following:

(i) Limiting concrete temperatures at placing as set out in sub-clause 5.13 (b);

(ii) Use of low heat cement, subject to the agreement of the Engineer;

(iii) Insulation of exposed concrete surfaces by insulating blankets. Such blankets shall have an insulation value at least equivalent to 50 mm of dry mineral wool;

(iv) leaving formwork in place during the curing period. Steel forms shall be suitably insulated on the outside;

(v) preventing rapid dissipation of heat from surfaces by shielding from wind;

(vi) Avoiding the use of water sprays when such use would cause rapid cooling of the surface.

6.11 Protection Of Fresh Concrete

Freshly placed concrete shall be protected from rainfall and from water running over the surface until it is sufficiently hard to resist damage from these causes.

No traffic shall be allowed on any concrete surface until such time as it is hard enough to resist damage by such traffic.

Concrete placed in the works shall not be subjected to any loading until it has attained at least its nominal strength as defined in Clause 5.4.

If the Contractor desire to impose loads on newly-placed concrete, he shall make at least three test cubes and cure them in the same conditions as the concrete they represent. These cubes shall be tested singly at suitable intervals in order to estimate the time at which the nominal strength is reached.

6.12 Concreting In Hot Weather

6.12.1 (a) General

The Contractor shall prevent damage to concrete arising from Exposure to extreme temperatures, and shall maintain in good working order all plant and equipment required for this purpose.

In the event that conditions become such that even with the use of the equipment the requirements cannot be met, concrete placing shall immediately cease until such time as the Requirements can again be met.

6.12.2 (b) Concrete placing in hot weather

During hot weather the contractor shall take all measures necessary to ensure that the temperature of concrete at the time of placing in the works does not exceed 30^{o}c and that the concrete does not lose any moisture during transporting and placing.

Such measures may include but are not necessarily limited to the following:-

(i) Shielding aggregates from direct sunshine.

(ii) Use of a mist water spray on aggregates.

(iii) Sun shields on mixing plants and transporting equipment.

(iv) Cooling the mixing water. If ice is used for this purpose it should preferably be in flake form. Lump ice shall not be allowed to enter the tank supplying the mixer drum.

(v) Covering skips closely with polythene sheet so that the latter is in contact with the concrete.

Areas in which concrete is to be placed shall be shielded from direct sunshine and rock or concrete surfaces shall be thoroughly wetted to reduce absorption of water from the concrete placed on or against them.

After concrete in any part of an area has been placed, the selected curing process shall be commenced as soon as possible. If any interval occurs between completion of placing and start of curing, the concrete shall be closely covered during the interval with polythene sheet to prevent loss of moisture.

6.13 Finishes On Unformed Surfaces

Horizontal or nearly horizontal surfaces which are not cast against formwork shall be finished to the class shown on the Drawings and defined hereunder.

6.13.1 UF 1 finish

All surfaces on which no higher class of finish is called for on the Drawings or instructed by the Engineer shall be given an UF 1 finish.

The concrete shall be leveled and screeded to produce a uniform plain or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.

6.13.2 UF 2 finish

This is a floated finish for roof or floor slabs and other surfaces where a hard trowelled surface is not required.

The surface shall first be treated as a Class UF 1 finish and after the concrete has hardened sufficiently, it shall be floated by hand or machine sufficient only to produce a uniform surface free from screed marks.

6.13.3 UF 3 finish

This is a hard trowelled surface for use where weather resistance or appearance is important, or which is subject to high velocity water flow.

The surface shall be floated as for a UF 2 finish but to the tolerance stated below. When·the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, it shall be steel-trowelled under firm pressure to produce a dense, smooth uniform surface free from trowel marks.

Table 5-3 Surface Tolerances

Class of Finish	Tolerance in mm. see notes		
	A	B	C
UF 1	Not applicable	10	+ 20 or - 10
UF 2	Nil	10	+ 20 or - 10
UF 3	Nil	5	+ 12.5 or - 7.5

Notes:

1. Col A is the maximum allowable value of any sudden change of level in the surface.
2. Col B is the maximum allowable value of any gradual irregularity of the surface, as indicated by the gap between the surface and a three metre long straight edge or correctly shaped template placed on the surface.
3. Col C is the maximum allowable value of the difference in level or position between a three metre long straight edge or correctly shaped template placed on the surface and the specified level or position of that surface.

4. Where dimensional tolerances given on the Drawings or in this Special Specification they shall take precedence over those given in Table 5-3.

6.14 Mortar

This clause covers mortar for use ahead of concrete placing, and other uses not covered elsewhere in the Specification.

Mortar shall be composed of fine aggregate complying with sub-Clause 5.3 (c) and Ordinary Portland Cement complying with KS02-21. The mix proportions shall be as stated on the Drawings or elsewhere in this Specification or if not stated shall be one part of cement to two parts of fine aggregate by weight.

Small quantities of mortar may be hand mixed but for amounts over 0.5 m^3 a mechanical mixer shall be used.

The water content of the mortar shall be as low as possible consistent with the use for which it is required but in any case the water/cement ratio shall not be more than 0.5.

Mortar which is specified as 'dry pack' shall be mixed with sufficient water for the mix to become cohesive but not plastic when squeezed in the hand. Dry pack mortar shall be rammed into the cavity it is required to fill, using a hand rammer with sufficient force to ensure full compaction.

6.15 Concrete For Secondary Purposes

(a) **Non-structural concrete (NS concrete)** shall be used only for non-structural purposes where shown on the Drawings.

NS concrete shall be composed of Ordinary Portland Cement complying with KS02-2l and aggregates complying with BS 862 including all-in aggregate within the grading limits of Table 3 of BS 682.

The weight of cement mixed with 0.3 m^3 metres of combined or all-in aggregate shall not be less than 50 kg. The mix shall be proportioned by weight or by volume. The maximum aggregate size shall be 40 mm nominal.

The concrete shall be mixed by machine or by hand to a uniform colour and consistency before placing. The quantity of water used shall not exceed that required to produce a concrete with sufficient workability to be placed and compacted where required.

The concrete shall be compacted by hand or by mechanical vibration.

(b) **No Fines concrete (NF concrete)** is intended for use where a porous concrete is required and shall only be used where shown on the Drawings or instructed by the Engineer.

The mix shall consist of Ordinary Portland Cement complying with KS02-2l and aggregate complying with BS 882. The aggregate size shall be 40.0 mm to 10.0 mm only. The weight of cement mixed with 0.3 m^3 metre of aggregate shall not be less than 50 kg. The quantity of water shall not exceed that required to produce a smooth cement paste which will coat evenly the whole of the aggregate.

6.16 Records of Concrete Placing

Records, in a form agreed by the Engineer, shall be kept by the Contractor of the details of every pour of concrete placed in the works. These records shall include class of concrete, location of pour, date of pour, ambient temperature and concrete temperature at time of placing, moisture contents of aggregates, details of mixes, batch numbers, cement batch number, results of all tests undertaken, location of test cube sample points and details of any cores taken.

The Contractor shall supply to the Engineer four copies of these records each week covering work carried out the preceding week. In addition he shall supply to the Engineer monthly histograms of all 28 day cube strengths together with accumulative and monthly standard deviations and any other information which the Engineer may require concerning the concrete placed in the works.

6.17 Construction Joints

Whenever concrete is to be bonded to other concrete which has hardened, the surface of contact between the sections shall be deemed a construction joint.

Where construction joints are shown on the Drawings, the Contractor shall form such joints in those positions. The location of joints which the Contractor requires to make for the purpose of construction shall be subject to the agreement of the Engineer. Construction joints shall be in vertical or horizontal planes except in sloping slabs where they shall be normal to the exposed surface or elsewhere where the Drawings require a different arrangement.

Construction joints shall be so arranged as to reduce to a minimum the effects of shrinkage in the concrete after placing, and shall be placed in the most advantageous positions with regard to stresses in the structures and the desirability of staggering joints.

Feather edges of concrete at joints shall be avoided and any feather edges which may have formed where reinforcing bars project through a joint shall be cut back until sound concrete has been reached.

The intersections of horizontal or near horizontal joints and exposed faces of concrete shall appear as straight lines produced by use of a guide strip fixed to the formwork at the top of the concrete lift, or by other means acceptable to the Engineer.

Construction joints formed as free surfaces shall not exceed a slope of 20 per cent from the horizontal. .

The surface of the fresh concrete in horizontal or near horizontal joints shall be thoroughly cleaned and roughened by means of high pressure water and air jets when the concrete is hard enough to withstand the treatment without the leaching of cement. The surface of vertical or near vertical joints shall be similarly treated if circumstances permit the removal of formwork at a suitable time.

Where concrete has become too hard for the above treatment to be successful, the surface whether formed or free is to be thoroughly scrabbled by mechanical means or wet sand blasted and then washed with clean water. The indentations produced by scrabbling shall be not less than 10 mm deep and shall not extend closer than 40 mm to a finished face.

If instructed by the Engineer the surface of the concrete shall be thoroughly brushed with a thin layer of mortar composed of one part of cement to two parts of sand by weight and complying with Clause 5.4 all as set out in Sub-Clause 5.9.2 (b) immediately prior to the deposition of fresh concrete. The mortar shall be kept just ahead of the fresh concrete being placed and the fresh layer of concrete shall be thoroughly and systematically vibrated to full depth to ensure complete bond with the adjacent layer.

No mortar or concrete may be placed in position on or against a construction joint until the joint as been inspected and passed by the Engineer.

6.18 Expansion and Contraction Joints

Expansion and contraction joints are discontinuities in concrete designed to allow for thermal or other movements in the concrete.

Expansion joints are formed with a gap between the concrete faces to permit subsequent expansion of the concrete. Contraction joints are formed to permit initial contraction of the concrete and may include provision for subsequent filling.

Expansion and contraction joints shall be formed in the positions and in accordance with the details shown on the Drawings or elsewhere in the Specifications.

6.19 Waterstops

All references to waterstops include grout stops.

Waterstops shall be of the material and form shown on the Drawings. No water-stop material shall be brought onto site until the Contractor has submitted full details of the materials he proposes to use, including samples, and these have been approved by the Engineer. All samples shall be of adequate length for testing.

Waterstops shall be made of material which are resistant to chlorides, sulphates, or other deleterious substances which may be present in the environment of the Works.

Rubber waterstops may be of natural of synthetic rubber and shall have an elongation at breaking stress of at least 500 per cent at 25°C and shall allow a joint movement of at least 50 mm.

Polyvinyl chloride (PVC) waterstops shall be extruded from unfilled plasticised PVC polymer or copolymer which does not contain any reclaimed or scrap PVC. PVC waterstops shall have an elongation at breaking stress of at least 225 per cent at 25°C and shall allow a joint movement of at least 10 mm.

Low modulus waterstops shall be of rubber or PVC as described above but shall have an elongation of at least 200 per cent at 25°C under a tensile stress of 6 N/mm^2 and shall allow a joint movement of at least 50 mm.

Waterstops shall be supplied in lengths as long as possible consistent with ease of handling and construction requirements.

In rubber or plastic materials joints other than butt joints shall be supplied ready made by the manufacturer. Butt joints shall be made on site in accordance with the manufacturer's instructions and with equipment supplied for the purpose by the manufacturer.

Waterstop material shall be stored carefully on Site to avoid damage and contamination with oil, grease, or other pollutants. Rubber and plastic waterstops shall be stored in cool well ventilated places away from direct sunlight.

Rubber and plastic waterstops which are embedded in one side of a joint more than one month before the scheduled date of placing concrete on the other side shall be protected from the sun.

Waterstops shall be firmly fixed in the formwork so that they cannot be displaced during concrete placing and shall be completely free of all dirt, grease, oil, etc before placing concrete. Where eyelets are provided these shall be fully wired to the reinforcement and be the only means whereby the waterstop is fixed. In no circumstances shall a waterstop be punctured with nails etc as a means of fixing.

Concrete shall be placed carefully round waterstops so as to avoid distortion or displacement and shall be fully compacted. Where waterstops lie in a horizontal or nearly horizontal plane the Contractor shall ensure that no voids are left on the underside of the waterstop.

Formwork round waterstops shall be carefully removed to avoid damage. If waterstops suffer any damage which cannot be properly repaired in situ the Engineer may require a section of concrete to be removed and the waterstop replaced.

6.20 Grouting Of Pockets and Holes and Underpinning of Baseplates

Pockets and holding-down boltholes shall be thoroughly cleaned out using compressed air and water jet. Holes drilled by a diamond bit shall be roughened. The pockets and holes shall be filled with grout consisting of cement and clean fresh water mixed in proportion of two parts by weight of cement to one part by weight of water. The pouring of liquid grout shall cease as soon as each hole is filled and any excess grout on the surface of the concrete foundation shall be completely removed and the surface dried off before the next operation proceeds.

The space between the top surface of foundation concrete and the underside of base plates shall be filled with a special mortar made up in the following proportions:-

Portland cement... . 50 kg

Fine aggregate .. . 50 kg

An additive acceptable to the Engineer to counteract shrinkage in proportions recommended by the manufacturer

The special mortar shall be mixed with -the lowest water-cement ratio which will result in a consistency of mix of sufficient workability to enable maximum compaction to be achieved.

The special mortar shall then be well rammed in horizontally below the baseplate and from one edge only until it is extruded from the other three sides. The mortar which has extruded shall then be rammed back to ensure complete support without voids.

6.21 Formwork for Concrete

Definitions

Formwork means the surface against which concrete is placed to form a face, together with all the immediate supports to retain it in position while concrete is placed.

Falsework means the structural elements supporting both the formwork and the concrete until the concrete becomes self supporting.

A **formed face** is one which has been cast against formwork.

An **exposed face** is one which will remain visible when construction has been completed.

6.22 Construction of Formwork and Falsework

Before construction begins, the Contractor shall submit to the Engineer drawings showing details of the proposed formwork and falsework.

Formwork and falsework shall be so constructed that they will support the loads imposed on them by the fresh concrete together with additional stresses imposed by vibrating equipment and by construction traffic, so that after ·the concrete has hardened the formed faces shall be in the positions shown on the Drawings within the tolerances set out in Clause 5.26.

Ground supports shall be properly founded on footings designed to prevent settlement.

Joints in formwork for exposed faces shall, unless otherwise specified, be evenly spaced and horizontal or vertical and shall be continuous or form a regular pattern.

All joints in formwork including formwork for construction joints shall be tight against the escape of cement and fines. Where reinforcement projects through formwork, the form shall fit closely round the bars.

Formwork shall be so designed that it may be easily removed from the work without damage to the faces of the concrete. It shall also incorporate provisions for making minor adjustments in position, if required, to ensure the correct location of concrete faces. Due allowance shall be made in the position of all formwork for movement and settlement under the weight of fresh concrete.

Where overhangs in formwork occur, means shall be provided to permit the escape of air and to ensure that the space is filled completely with fully compacted concrete.

Formwork shall be provided for concrete surfaces at slopes of 30" to the horizontal or steeper. Surfaces at slopes less than 20° may be formed by screeding. Surfaces at slopes between 20° and 30° shall generally be formed unless the Contractor can demonstrate to the satisfaction of the Engineer that such slopes can be screeded with the use of special screed boards to hold the concrete in place during vibration Horizontal or inclined formwork to the upper surface of concrete shall be adequately secured against uplift due to the pressure of fresh concrete. Formwork to voids within the body of the concrete shall also be tied down or otherwise secured against floating.

The internal and external angles on concrete surfaces shall be formed with fillets and chamfers of the sizes shown on the Drawings unless otherwise instructed by the Engineer.

Supports for formwork may be bolted to previously placed concrete provided the type of bolt used is acceptable to the Engineer. If metal ties through the concrete are used in conjunction with bolts, the metal left in shall not be closer than 50 mm to the face of the Concrete.

Formwork shall not be re-used after it has suffered damage which is sufficient to impair the finished surfaces of the concrete.

Where circumstances prevent easy access within the form for cleaning and inspection, temporary openings for this purpose shall be provided through the formwork.

Shear keys shall be provided in all construction joints of the size and shape indicated on the Drawings.

Where precast concrete elements are specified for use as permanent formwork, or proposed by the Contractor and agreed by the Engineer, they shall comply with the requirements of the Specification. Such elements shall be set true to line and level within the tolerances prescribed for the appropriate class of finish in Clause 5.26 and fixed so that they cannot move when concrete is placed against them.

6.23 Preparation of Formwork

Before any reinforcement is placed into position within formwork, the latter shall be thoroughly cleaned and then dressed with a release agent. The agent shall be either suitable oil incorporating a wetting agent, an emulsion of water suspended in oil or a low viscosity oil containing chemical agents. The contractor shall not use an emulsion of oil suspended in water nor any release agent which causes staining, discoloration of the concrete, air holes on the concrete surface, or retards the rest of the concrete. in order to avoid colour differences on adjacent concrete surfaces, only one type or release agent shall be used in any one section of the works. In cases where it is necessary to fix reinforcement before placing formwork, all surface preparation of formwork shall be carried out before it is placed into position. The Contactor shall not allow reinforcement or prestressing tendons to be contaminated with formwork release agent

Before placing concrete all dirt, construction debris and other foreign matter shall be removed completely from within the placing area.

Before concrete placing commences, all wedges and other adjusting devices shall be secured against movement during concrete placing and the Contractor shall maintain a watch on the formwork during placing to ensure that no movement occurs.

6.24 Removal Of Formwork

Formwork shall be carefully removed without shock or disturbance to the concrete. No formwork shall be removed until the concrete has gained sufficient strength to withstand safely any stresses to which it may thereby be subjected.

The minimum periods which shall elapse between completion of placing concrete and removal of forms are given in Table 5-4 and apply to ambient temperatures higher than l0°C at lower temperatures or if cement other than ordinary Portland are involved, the Engineer may instruct longer periods.

Alternatively, formwork may be removed when the concrete has attained the strength set out in Table 5-4, provided that the attained strength is determined by

making test cubes and curing them under the same conditions as the concrete to which they refer.

Compliance with this requirement shall not relieve the Contractor of his obligation to delay removal of formwork until the removal can be completed without damage to the concrete.

Table 5-4 Minimum Periods for Formwork Removal

Position of Formwork	Minimum Period for Temps over l0°C	Strength to b Attained
Vertical or near vertical faces of mass concrete	24 hours	0.2 C
Vertical or near vertical faces of reinforced walls, beams and columns	48 hours	0.3 C
Underside of arches beams and slabs (formwork only)	4 days	0.5 C
Supports to underside of arches, beams and slabs	14 days	C
Arched linings in tunnels and under-ground works	24 hours	$4N/mm^2$

NOTE: C is the nominal strength for the class of concrete used.

If the Contractor wishes to strip formwork from the underside of arches beams and slabs before the expiry of the period (or supports set out above), it shall be designed so that it can be removed without disturbing the supports. The Contractor shall not remove supports temporarily for the purpose of stripping formwork and subsequently replace them.

As soon as the formwork has been removed, bolt holes in concrete faces other than construction joints which are not required for subsequent operations shall be completely filled with mortar sufficiently dry to prevent any slumping at the face. The mortar shall be mixed in the same proportions as the fine aggregate and cement in the surrounding concrete and with the same materials and shall be finished flush with the face of the concrete.

6.25 Surface Finishes

Classes of finish

The surface finish to be achieved on formed concrete surfaces shall be as shown on the Drawings and defined hereunder:-

6.25.1 (a) Class Fl finish

This finish is for surfaces against which backfill or further concrete will be placed. Formwork may be sawn boards, sheet metal or any other suitable material which will prevent the loss of fine material from the concrete being p1aced.

6.25.2 (b) Class F2 finish

This finish is for surfaces which are permanently exposed to view but where the highest standard of finish is not required. Forms to provide a Class F2 finish shall be faced with wrought thicknesses tongued and grooved boards with square edges arranged in a uniform pattern and close jointed or with suitable sheet material. The thickness of boards or sheets shall be such that there shall be no visible deflection under the pressure exerted by the concrete placed against them. Joints between boards or panels shall be horizontal and vertical unless otherwise directed. This finish shall be such as to require no general filling of surface pitting, but fins, surface discolouration and other minor. Defects shall be remedied by methods agreed by the Engineer.

6.25.3 (c) Class F3 finish

This finish is for surfaces which will be in contact with water flowing at high velocity, and for surfaces prominently exposed to view where good appearance is of special importance. To achieve this finish, which shall be free of board marks, the formwork shall be faced with plywood complying with BS 1088 or equivalent material in large sheets. The sheets shall be arranged in an approved uniform pattern. Wherever possible, joints between sheets shall be arranged to coincide with architectural features or changes in direction of the surface.

All joints between panels shall be vertical and. Horizontal unless otherwise directed. Suitable joints shall be provided between sheets to maintain accurate alignment in the plane of the sheets. Unfaced wrought boarding or standard steel panels will not be permitted for Class F3 finish. The Contractor shall ensure that the surface is protected from rust marks, spillages and stains of all kinds.

6.25.4 (d) Curved surfaces

For curved surfaces where F2 or F3 finishes are called for, the formwork face shall be built up of splines cut to make a tight surface which shall then be dressed to produce the required finish.

Alternatively single curvature surfaces may be faced with plastic or plywood linings attached to the backing with adhesive or with escutcheon pins driven flush. Linings shall not bulge, wrinkle or otherwise deform when subjected to temperature and moisture changes.

6.26 Tolerances

All parts of formed concrete surfaces shall be in the positions shown on the Drawings within the tolerances set out in Table 5-5.

In cases where the Drawings call for tolerances other than those given in Table 5-5 the Drawings shall rule.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to produce a satisfactory straight or curved line. When the Engineer has approved the alignment, the Contractor shall fix the units so that there is no possibility of further movement.

Table 5-5 Tolerances

Class of finish	Tolerances in mm (See Note)

	A	B	C
F1	10	10	+ 25 to - 10
F2	5	10	+ or - 15
F3	2	5	+ or - 10

Note: The tolerances A, B and C given in the table are defined as follows:

A is an abrupt irregularity in the surface due to misaligned formwork or defects in the face of the formwork.

B is a gradual deviation from a plane surface an indicated by a straight edge 3 m long. In the case of curved surfaces the straight edge shall be replaced by a correctly shaped template.

C is the amount by which the whole or part of a concrete face is displaced for the correct position shown on the Drawings.

6.27 Remedial Work To Defective Surfaces

If on stripping any Formwork the concrete surface is found to be defective in any way, the Contractor shall make no attempt to remedy such defects prior to the Engineer's inspection and the receipt of any instructions which the Engineer may give.

Defective surfaces shall not be made good by plastering.

Areas of honeycombing which the Engineer agrees may be repaired shall be cut back to sound concrete r to 75 mm whichever is the greater distance. In the case of reinforced concrete the area shall be cut back to at least 25 mm clear distance behind the reinforcement or to 75 mm, whichever is the greater distance. The cavity shall have sides at right angles to the face of the concrete after cleaning out with water and compressed air, a thin layer of cement grout shall be brushed on to the concrete surfaces in the cavity and it shall then be filled immediately with concrete of the same class as the main body but with aggregate larger than 20 mm nominal size removed.

A form shall be used against the cavity, provided with a lip to enable concrete to be placed. The form shall be filled to point above the top edge of the cavity.

After seven days the lip of concrete shall be broken off and the surface ground smooth.

Surface irregularities which are outside the limits of tolerance set out in Clause 5.26 shall be ground and in the manner and to the extent instructed by the Engineer.

Defects other than those mentioned above shall be dealt with as instructed by the Engineer. '

6.28 Reinforcement For Concrete

Reinforcement which shall comply with the following British Standards, covers plain and deformed bar reinforcement and steel fabric to be cast into concrete in any part of the works but does not include prestressing tendons or any other embedded steel.

- BS 4449 for hot rolled plain bar and high yield deformed bar
- BS 4482 for hard drawn mild steel wire
- BS 4461 for cold worked steel bar
- BS 4483 for steel mesh fabric

All reinforcement shall be from an approved manufacturer and, if required by the Engineer, the Contractor shall submit a test certificate from the manufacturer.

All reinforcement for use in the Works shall be treated for compliance with the appropriate British Standard in a laboratory acceptable to the Engineer and two copies of each test certificate shall be supplied to the Engineer. The frequency of testing shall be as set out in the British Standard.

In addition to the testing requirements described above, the Contractor shall carry out additional tests as instructed by the Engineer.

Any reinforcement which does not comply with the Specification shall be removed from Site.

6.29 Storage Of Reinforcement

All reinforcement shall be delivered to Site either in straight lengths or cut and bent. No reinforcement shall be accepted in long lengths which have been transport bent over double.

Any reinforcement which is likely to remain in storage for a long period shall be protected from the weather so as to avoid corrosion and pitting. All reinforcement which has become corroded or pitted to an extent which, in the opinion of the Engineer, will affect its properties shall either be removed from Site or may be tested for compliance with the appropriate British Standard in accordance with Clause 5.28 of this Specification at the Contactor's expense.

6.30 Bending Reinforcement

Unless otherwise shown on the drawings, bending and cutting shall comply with BS 4466.

The Contractor shall satisfy himself as to the accuracy of any bar bending schedules supplied and shall be responsible for cutting, bending, and fixing the reinforcement in accordance with the Drawings.

Bars shall be bent cold by the application of slow steady pressure. At temperatures below 5^{o}c the rate of bending shall be reduced if necessary to prevent fracture of the steel.

After bending, bars shall be securely tied together in bundles or groups and legibly labelled as set out in BS 4466.

Reinforcement shall be thoroughly cleaned and all dirt, scale, loose rust, oil and other contaminants removed before it is placed in the Works.

6.31 Fixing Reinforcement

Reinforcement shall be securely fixed in position within a dimensional tolerance of 20 mm in any direction parallel to a concrete face and within a tolerance of 5 mm at right angles to a face, provided that the cover is not thereby decreased below the minimum shown on the Drawings, or if not shown shall be not less than 25mm or the diameter of the bar, whichever is the greater. Cover on distribution steel shall not be less than 15mm or the diameter of whichever is the greater.

Unless otherwise agreed by the engineer , all intersecting bars shall either be tied together with 1.6 mm diameter soft annealed iron wire and the ends of .the wire turned into the body of the concrete , or shall be secured with a wire clip of a type agreed by the Engineer.

Spacer blocks shall be used for ensuring that the correct cover is maintained on the reinforcement. Blocks shall be as small as practicable and of a shape agreed by the Engineer. They shall be made of mortar mixed in the proportions of one part of cement to two parts of sand. Wires cast into the block for tying in to the reinforcement shall be 1.6 mm diameter soft annealed iron.

Alternatively another type of spacer block may be used subject to the Engineer's agreement.

Reinforcement shall be rigidly fixed so that no movement can occur during concrete placing. Any fixings made to the formwork shall not be within the space to be occupied by the concrete being currently placed.

No splices shall be made in the reinforcement except where shown on the Drawings or agreed by the Engineer. Splice lengths shall be as shown on the Drawings.

Reinforcement shall not be welded except where required by the Contract or agreed by the Engineer. If welding is employed, the procedures shall be as set out in BS2640 for gas welding or BS 5135 for metal arc welding. Full strength butt welds shall only be used for steel complying with BS 4449, and if used on high yield deformed bars complying with BS 4449 the permissible stresses in the vicinity of the weld shall be reduced to those applicable to plain bars complying with that specification.

Mechanical splices shall not be used unless the Engineer agrees otherwise.

The Contractor shall ensure that reinforcement left exposed in the Works shall not suffer distortion, displacement or other damage. When it is necessary to bend protruding reinforcement aside temporarily, the radius of the bend shall not be less than four times the bar diameter for mild steel bars or six times the bar diameter for high yield bars. Such bends shall be carefully straightened before concrete placing continues, without leaving residual kinks or damaging the concrete round them. In no circumstances will heating and bending of high yield bars be permitted.

Bars complying with BS 4461 or other high tensile bars shall not be bent after placing in the Works.

Before concrete is placed in any section of the Works that includes reinforcement, the reinforcement shall be completely clean and free from all contamination including concrete, which may have been deposited on it from previous operations.

6.32 Precast Concrete

Precast concrete covers all precast units for use in the Works, whether instructed under the Contract or proposed by the Contractor, and includes prestressed units where applicable. Additional requirements for prestressed units are set out in Section 18 of this Specification.

6.33 Moulds For Precast Units

Moulds for precast units shall comply with the general requirements of Clauses 5.21 to 5.29.

Moulds shall be so constructed that they do not suffer distortion or dimensional changes during use and are tight against loss of cement grout or fines from the concrete.

Moulds shall be set up on firm foundations so that no settlement occurs under the weight of the fresh concrete.

Moulds shall be constructed so that units may be removed from them without sustaining any damage.

Release agents used for de-moulding shall not stain the concrete or affect its properties in any way.

6.34 Reinforcement for Precast Units

Reinforcement in precast units shall comply with the requirement of Clauses 5.28 to 5.31. When preformed cages are used, the cages shall be made up on jigs to ensure dimensional accuracy and shall be carefully supported within the mould in such a way that they cannot move when concrete is placed. Reinforcement complying with BS 4449 may be tack welded where bars cross to provide rigidity in the cage but reinforcement complying with BS 4461 shall not be welded.

Cover to main reinforcement shall be as shown on the Drawings, or if not shown shall be not less than 25 mm or the diameter of the bar, whichever is the greater. Cover on distribution steel shall not be less than 15 mm or the diameter of the bar whichever is the greater.

Bars shall be spaced so that the minimum clear distance between them is the maximum nominal aggregate size plus five millimeters but in any case not less than the diameter of the bars.

Bars may be placed in pairs provided that there are no laps in the paired lengths.

6.35 Casting Of Units

Concrete for precast units shall comply with Clauses 5.03 to 5.09 using the class of concrete specified on the Drawings.

If lightweight aggregates are specified, they shall comply with BS 3797.

The area in which the units are cast shall be adequately protected from weather so that the process is not affected by rain, sun or drying winds.

6.36 Curing Precast Units

Requirements for curing shall be generally as set out in Clause 5.10. The Contractor shall ensure that units do not suffer any loss of moisture or sudden changes of temperature for at least four days after casting. If a water spray is used for curing,

the water shall be at a temperature within 5^{o}c of the temperature of the unit being cured.

If the Contractor proposes curing at elevated temperature, the method shall be subject to the agreement of the Engineer and shall include means whereby units' are heated and subsequently cooled evenly without sudden changes of temperature.

6.37 Dimensional Tolerances Of Precast Units

Units shall be accurately formed to the dimensions shown on the Drawings and within the tolerances set out in BSCP 110 unless closer tolerances are called for in the Special Specification or on the Drawings

6.38 Surface Finish Of Precast Units

The formed faces of precast units shall be finished to Class F3 as set out in Clause 5.25 unless another class of finish is specified on the Drawings.

Free faces shall be finished to Class UF2 unless another class of Finish is specified on the Drawings.

In cases where a special finish is required a trial panel shall be constructed by the Contractor which after approval by the Engineer shall be kept available for inspection at the place of casting and production units shall thereafter match the approved pattern.

Those parts of the unit which are to be joined to other units or to in situ concrete shall be brushed with a stiff brush before the concrete has fully hardened. Alternatively, if the concrete has been allowed to harden, the surfaces shall be roughened by sand blasting or the use of a needle gun.

6.39 Handling And Storage Of Precast Units

Precast units shall be handled in a manner which will not cause any kind damage and of shall be stored on a hard impermeable base.

Prestressed units and large precast normally rein forced units shall be handled and stored so that no stresses shall be induced in excess of those which they will incur in their final positions in the Works unless they have been designed to resist such stresses.

Units shall be provided with adequate lifting holes or loops, placed in the locations shown on the Drawings or agreed by the Engineer and they shall be lifted only by such holes or loops. Where it is not possible to provide holes or loops, suitable sling positions shall be indicated in paint on the units.

Units shall be marked indelibly with the reference number and date of casting and shall be stacked on suitable packers which will not damage the concrete or stain the surfaces. Not more than two packers shall be placed under each unit and these shall be located either at

The positions of the permanent support points or in positions such, that the induced stresses in the unit will be a minimum.

6.40 Testing Precast Units

Precast units shall be capable of safely sustaining the load which they have been designed to carry. The Contractor shall subject units selected by the Engineer to

load tests simulating the working conditions. Details of such tests shall be agreed between the Engineer and the Contractor.

In the case of units subject to bending loads the test piece shall be supported at full span and a loading equivalent to 1.25 times the sum of the live and dead loads which were assumed in the design shall be maintained for one hour without the appearance of any signs of distress. The recovery one hour after the removal of load shall be not less than 75 per cent of the full load deflection.

If the unit fails to meet the above requirements, further tests shall be carried out on two more units. If either of these fail the whole batch of units will be rejected.

If the Engineer so requires, a test to destruction shall also be carried out which on units subject to bending shall be as follows:-

The units shall be supported at full span and a load applied in increments instructed by the Engineer up to 95 per cent of the designed ultimate load. This load shall be held for 15 minutes without failure of the unit. The deflection at the end of this period shall be not more than l/40th of the span. The load shall then be further increased until failure occurs.

If the unit fails to sustain the required load for the prescribed period or if the deflection exceeds the specified amount, the Engineer may order two further tests, and if either of these fails, the batch of units which they represent may be rejected.

6.41 Measurement and payment

6.41.1 (a) Item : Concrete

Unit : m^3 of each class

Concrete shall be measured by the cubic metre of each class calculated from the dimensions given on the Drawings or instructed by the Engineer. No deduction shall be made in the measurement for:

(i) bolt holes, pockets, box outs and cast in components provided that the volume of each is less than 0.15 cubic metres;

(ii) mortar beds, fillets, drips, rebates, recesses, grooves, chamfers and the like of 100 mm total width or less;

(iii) reinforcement

The rate for concrete shall include for the cost of:-

(i) Provision and transport of cement aggregates and. water.

(ii) Admixtures and workability agents including submission of details unless specified.

(iii) Hatching, mixing, transporting, placing, compacting and curing.

(iv) Class UF1 finish.

(v) Laying to sloping outfaces not exceeding 15° from the horizontal and to falls.

(vi) Formwork to blinding concrete.

(vii) Placing and compacting against excavated surfaces where required including any additional concrete to fill overbreak or working space.

(viii) Complying with the requirements of Clauses 5.1 to 5.18 inclusive and Clause 5.27 of this Specification.

6.41.2 (b) Item: Blinding concrete

Unit: m^3

Blinding concrete shall be measured by the cubic metre calculated as the product of the plan area of the foundation as shown on the Drawings and the instructed thickness. No deduction shall be made for openings provided that the area of each is less than 0.5 square metres. Blinding concrete over hard material shall be measured as the volume used provided that the maximum thickness of 150 mm allowed for overbreak is not exceeded.

The rate for blinding concrete shall include for all costs itemized in Clause 5.4l.1 (a) of this Specification.

6.41.3 (c) Item: No fines concrete.

Unit: m^3

No fines concrete shall be measured by the calculated cubic metre from the dimensions given on Drawings or instructed by the Engineer.

The rate for no fines concrete shall include: for all costs stated in Clause 5.4l.1 (a) of this Specification.

6.41.4 (d) Item: Unformed surface finishes

Unit m^2 of each class of finish

Unformed surface finishes shall be measured by the square metre from the dimensions given on the Drawings or instructed by the Engineer.

The rate for concrete in Clause 5.41.1 (a), 5.41.2 (b) and 5.41.3 (c) shall include for class UFI finish.

The rate for unformed surface finishes shall include for the cost of complying with Clause 5.13 of this Specification.

6.41.5 (e) Item: Formed surface finishes

Unit: m^2 of formed Surface for each class of finish for each range of inclinations.

Except as stated below, formed surfaces shall be measured by the square metre of th finished face of the concrete. No deduction shall be made in the measurement for openings, pipes, ducts and the like, provided that the area of each is less than 0.50 square metres.

Formed Surfaces less than 300 mm high to edges of slabs shall be measured by the linear metre in accordance with Clause 5.4l.6 (f) of this Specification.

Formed Surfaces required for blinding concrete, to form construction joints and shear keys for future concrete and other construction surfaces shall not be measured and the costs shall be included in the rates for other work.

Formed Surfaces to contraction and expansion joints shall be measured by the square metre on one face only. The rates shall include for the costs stated below and for forming recesses for sealant and channels for grout.

The rates for formed Surface shall include for the cost of submission of details providing and transporting all materials for formwork and falsework, erection including provision of supports, fillets and chamfers 75 mm and less in width, bolts, ties, fixings, cutting to waste, drilling or notching the formwork for reinforcement where required, working around pipes, ducts, conduits and waterstops, temporary openings, cleaning, dressing, stripping, filling bolt holes and any remedial work and for complying with Clauses 5.08, 5.10, 5.17,5.18, 5.19 and 5.21 to 5.27 inclusive of this Specification.

The rate shall also include for costs of constucting formed surfaces to any inclination, shape or curvature as shown in the drawing or as instructed by the Engineer.

6.41.6 (f) Item Formwork to edges of slabs

Unit: m of each class of finish

Formwork less than 300 mm high to edges of slabs shall be measured by the linear metre.

The rates for formwork shall include for the cost of submission of details providing and transporting all materials for formwork and falsework, erection including provision of supports, fillets and chamfers 75 mm and less in width, bolts, ties, fixings, cutting to waste, drilling or notching the formwork for reinforcement where required, working around pipes, ducts, conduits and waterstops, temporary openings, cleaning, dressing, stripping, filling bolt holes and any remedial work and for complying with Clauses 5.08, 5.10, 5.17,5.18, 5.19 and 5.21 to 5.27 inclusive of this Specification.

6.41.7 (g) Item: Waterstops

Unit: m of each type

Waterstops shall be measured by the metre run of each type.

The rate for waterstops shall include for the provision installation, jointing, any sealants required at the face of the concrete and for placing and compacting concrete around the water stop.

6.41.8 (h) Item: Mortar

Unit: m^2

Mortar used for bedding base-plates and the like shall be measured by the square metre as the area of the base plate at the specified nominal thickness of bedding.

Mortar used in filling bolts pockets and the like shall not be measured separately and the costs shall be included in the rates for the bolts.The rates for mortar shall include for the cost of providing and placing the mortar and of complying with the requirements of Clauses 5.14 and 5.20 of this Specification.

6.41.9 (i) Item: Admixtures, workability and hardening agents

Unit: as per instruction of the Engineer

Where required by the Special Specification admixtures, "Workability and hardening agents will be measured and paid for in accordance with the Engineer’s Instructions.

6.41.10 (j) Item: Reinforcement

Unit: tonne of each type for each range of diameters. Reinforcement shall be measured separately for each of the following ranges.

(i) of diameter equal to or less than 16 mm.

(ii) of diameter greater than 16 mm.

(iii) Steel fabric reinforcement shall be measured in accordance with Clause 5.41.11 (k) of this Specification.

Steel plain and deformed bar reinforcement shall be measured by the tonne and shall be the calculated weight of the steel required including splice lengths shown on the Drawings. No allowance shall be made in the measurement for rolling margin or cutting waste. The density of Steel shall be taken as 7,850 kilograms per cubic metre.

The rates for reinforcement shall include for the cost of providing, cutting to length, splice lengths additional to those shown on the Drawings, laps, bending, hooking, waste incurred by cutting, cleaning, spacer blocks, provision and fixing of chairs or other types of supports, welding, fixing the reinforcement in position including the provision of wire or other material for supporting and tying the reinforcement in place, bending reinforcement aside temporarily and straightening, placing and compacting concrete around reinforcement and for complying with the requirements of Clause 5.28 to 5.31 inclusive of this Specification.

6.41.11 (k) Item: Fabric reinforcement

Unit: m^2 of each type

Steel fabric reinforcement s all be measured by the square metre and shall be the calculated area excluding any allowance for laps.

The rate for steel fabric reinforcement shall included for the costs stated in Clause 5.41 (j) of this Specification.

6.41.12 (1) Item: Precast Units

Unit: no. of each type

Precast units shall be measured by the number of each type instructed unless otherwise specified in the Special Specification.

The rate for precast units shall include for the cost of all the materials, forming, and placing units, complying with the requirements of Clauses 5.32 to 5.40 inclusive and with the relevant Clauses of the Special Specification.

No separate measurement or payment will be made for formwork reinforcement or prestressing tendons to precast units.

7. STRUCTURAL STEELWORK

7.1 General

The fabrication and erection of all structural steelwork shall be under the constant supervision of competent and experienced personnel. All workmanship shall be in accordance with the best modern workshop practice and only skilled workers trained and experienced in steel fabrication and erection shall be employed.

7.2 Applicable Standards

The supply, fabrication and erection of structural steelwork shall be in accordance with the provisions of the relevant clauses of the following British Standards:-

BS 4 Structural steel sections.

BS 4848 Hot rolled structural steel sections.

BS 153 Steel girder bridges,

Part 1 - Materials and workmanship and

Part 2 - Weighing, shipping and erection.

8S 4360 Weldable structural steels.

BS 4395 High strength friction grip bolts and associated

Parts 1&2 nuts and washers for structural engineering (metric series).

BS 4604 The use of high strength friction grip bolts in structural steelwork.

BS 2708 Unified Black Square and hexagon bolts, screws and nuts (UNC and UNF threads).

BS 4190 ISO metric black hexagon bolts screws and nuts.

BS 3692 ISO. metric precision hexagon bolt screws and nuts.

BS 4320 Metal washers for general engineering purposes.

BS 5135: Metal arc welding of carbon and manganese steels.

BS 638 Arc welding plant, equipment and accessories.

BS 639 Covered electrodes for the manual metal-arc welding of mild steel and medium tensile steel

BS 4870 Approval testing of welding procedures, Part 1 Fusion welding of steel.

BS 4871 Approval testing of welders working to approved welding procedures, Part 1-Fusion welding of steel.

BS 5493 Protective coating of iron and steel structures against corrosion.

7.3 Materials

All structural steel shall be to the Grade as defined on the Drawings and shall comply with the requirements of BS 4360 in every respect.

Mill certificates shall be supplied to the Engineer in duplicate to confirm the mechanical and chemical properties.

Steel for headed stud shear connectors shall have a minimum yield stress of 385 N/mm^2 and a minimum tensile strength of 495 N/mm^2.

7.4 Storage Of Materials

Structural steelwork whether plain or fabricated shall be stored above ground on platforms, skids or other supports and in such a way as to prevent pools of water forming on the ground. It shall be kept free from dirt, grease and other deleterious material and shall be protected as far as is practicable from corrosion. The time limits for outside storage of unpainted or primed steelwork shall be as detailed in the Special Specification.

7.5 Fabrication

Fabrication shall generally be in accordance with the requirements of BS 153 Part l, Workmanship. Rolled material, before being processed, must be straight or flat. Straightening or flattening, where required and where permitted by the Engineer, shall be accomplished by a process not harmful to the material.

The Contractor shall submit to the Engineer for his approval two sets of shop drawings with calculations as appropriate and the Contractor shall not commence fabrication until written approval has been given by the Engineer. The Engineer will give comment or approval within 28 days after receipt of the shop drawings and calculations. Such approval shall not relieve the Contractor of any of his responsibilities under the Contract.

Following approval of the shop drawings the Contractor shall supply to the Engineer a further four copies of each drawing for the use of the Engineer and the Employer.

The components of various members of the structure shall be placed in jigs of approved design and all welding shall be carried out in accordance with Clause 6.7 of this specification. Every precaution shall be taken to prevent distortion.

7.6 Preparation of Edges and Ends of Plates

Edges and ends shall be either:

(a) left as rolled, sawn, machine cut, machine flame cut;

(b) hand flame cut and ground to a smooth profile; or

(c) for stiffeners and gussets not exceeding 12 mm thick, sheared and subsequently ground to a smooth profile.

Where ends of stiffeners are required to be fitted, they shall be ground to be in contact with the flanges over 80% of the area of stiffener.

After shearing or flame cutting of plates, one of the following requirements shall be satisfied:

(a) The hardness of the out edge shall not exceed 350 HV 30 of BS 427;

(b) the cut edge is incorporated in a weld;

(c) the material from the edge is removed by machining or grinding to demonstrate that the hardness of the edge is less than 350 HV 30 of BS 427;

(d) the edge is softened by an approved heat treatment and is shown to be free from cracks by crack detection procedures; or

(e) the material is Grade 43 steel and is not greater than 40 mm thick and the edge preparation is by machine flame cutting.

7.7 Welding

Welding will be permitted only where shown on the Drawings and the agreed shop drawings.

All welding operations shall comply with the requirements of BS 5135. The details of all welds shall be arranged to achieve the most satisfactory welding procedure. The details of the welding procedure shall be submitted to the Engineer for his approval and no welding may commence without the prior approval of the Engineer. No departure from an approved procedure may be made without the prior approval of the Engineer. Welding procedure details to be submitted to the Engineer shall include the following:-

- Welding position.
- Fusion face preparation. Pre-heating.
- Electrode make, type and size and mechanical properties. Number and arrangement of runs.
- Welding current.
- Arc energy.
- Method of back gouging and sealing.
- Proposed methods of quality control and testing of welds.

Welding shall he carried out under the supervision of an experienced and competent supervisor in accordance with the requirements of BS

5135. The welders shall be tested in accordance with the requirements of BS 4871 prior to the commencement of the work.

The Contractor shall carry out trials of the welding procedure in accordance With the requirements of BS 4870.

Welding plant and accessories shall comply with the requirements of BS 638 and shall be used in accordance with the manufacturer's instructions. The welding plant shall be capable of maintaining at the weld the current and voltage specified by the manufacturer and in accordance with the welding procedure.

The electrodes shall be selected with regard to the quality of the material to be welded and the optimum performance with the welding procedures and shall comply with the requirements of BS 639. All electrodes shall be stored in their original packets in a dry and preferably heated place adequately protected from the weather and shall be handled with care and in accordance with the manufacturer’s instructions. Electrodes and fluxes that show signs of moisture, damage or deterioration shall not be used.

Welds shall be subject to non-destructive examination and testing as specified in the Special Specification.

Welded fabrications and weld quality shall comply with the requirements of the American Welding Society Specification ANSI/AWS DI.l.8l., section 9, PART D

Stud shear connectors shall be subjected to the following tests:-

a) (a)The fixing of studs after being welded in position shall be tested by striking the side of the head of the stud with a 2 kg hammer and shall pass such test if no part of the weld shows fracture or is dislodged thereby.

b) Any stud selected by the Engineer shall be capable of being bent by striking the side of the head of the stud with a 6 kg hammer until its head is displaced laterally a distance of approximately 0.25 times the height of the stud from its original position. The stud weld shall not show any signs of cracking or lack of fusion. Satisfactory studs shall not be bent back again.

   Studs whose welds have failed the tests given in (a) and/or (b) above shall be replaced according to a procedure to be agreed with the Engineer.

7.8 Bolting

7.8.1 (a) Black Bolts

All mild steel bolts, washers and nuts shall be of the grade as specified on the Drawings and shall comply with the requirements of BS 4190, BS 2708 or BS 3692 as appropriate.

All holes shall be drilled or drilled small and reamed and shall be clean cut without torn or ragged edges. The holes shall be perpendicular to the member and not more than 2mm larger than the nominal diameter of the bolt.

In all cases where the full bearing area of the bolt is to be developed the bolt shall be provided with a steel washer under the nut to avoid any threaded portion of the holt being within the parts bolted together. Tapered washers of the correct angle of taper shall be provided under all bolt heads and nuts bearing on bevelled surfaces.

7.8.2 (b) High Strength Friction Grip (HSFG) Bolts

HSFG bolts shall comply with the requirements of BS 4395 Parts 1 and 2 and shall be used in accordance with the provisions of BS 4604 Parts 1 and 2.

HSFG bolts, nuts and washers shall be supplied cadmium plated to BS 3382 to a thickness of 5 microns and shall be stamped or otherwise mar.ked with a suitable and permanent mark and the Contractor shall obtain the written approval of the Engineer to the proposed marks before commencement of the work.

Each HSFG bolt shall be supplied complete with its nut screwed on. washers may be supplied on the bolt or separately and bolts and washers shall be packed in the manufacturers works and delivered to site in waterproof containers and stored under cover in these until required :for use.

The method of tightening HSFG bolts shall be either the part turn method, the torque control method or with the use of load indicating washers in accordance with the following:-

HSFG bolts complying with standard	**Permissible methods of tightening.**
BS 4604 Part 1 and 2	**1) Part turn for bolts Ml6 and above**

	2) Torque control. **3) load indicating washers.**
BS 4604 Part 2	**1) Torque control.** **2) load indicating washers.**

Whatever method of tightening is adopted, the Contractor shall supply to the Engineer full details of the procedures to be adopted which shall be in accordance with the requirements of BS 4604, together with details of the tools and equipment he will be using at Site and the tests to be carried out to determine the tension characteristics of the tools, bolts and the load indicating washers. No bolting shall commence until the Contractor has carried out sufficient site tests to confirm the load/torque/shank tension characteristics of the tools and bolts.

In the case of torque control tightening methods, calibration of the equipment shall be carried out daily before commencing bolting operations in accordance with the requirements of BS4604.

Where load indicating washers are used they shall be of a type approved by the Engineer and used in accordance with manufacturer's instructions.

The general requirements of BS 4604 shall apply to the assembly and use of HSFG bolts with indicating washers including check testing to confirm minimum shank tension is being achieved.

HSFG bolts that have been slackened off after final tightening by any method shall be removed, discarded and replaced.

7.9 Transportation Handling and Erection

Erection shall be in accordance with BS 153 Part 2, Weighing, Shipping and Erection. Structural steel shall be handled with due care at all times and in such a manner as not to cause damage to the steelwork or its protective coatings.

The Contractor shall submit to the Engineer for his approval two sets of drawings and calculations and details showing his proposed methods for transport, handling and erection of structural steelwork including all plant, temporary supports and bracings required to ensure stability and safety during erection. The Contractor shall erect the steelwork, remove the temporary supports and do all the work required to complete the Works in accordance with the Drawings and this Specification. The work shall be carried out in such a manner as will not injure, overstress or disfigure any part of the structure or the foundations and any part injured, overstressed or disfigured shall be removed and replaced or rectified to comply with the requirements of this Specification.

The steelwork shall be temporarily erected at the fabrication works and be subject to inspection by the Engineer before being dispatched to Site.

Drift pins will be allowed only for bringing together the several parts of the structure, and shall not be used in such a way as to distort the work or enlarge the bolt holes.

Bolts in site connections shall not be finally tightened until sufficient of the structure is properly plumbed, aligned and levelled and no subsequent straining into position will be allowed. Finally all bolts and connections shall be systematically checked and tightened.

7.10 Surface Preparation of Steelwork

Surface preparation of steelwork shall be by blast cleaning in accordance with the requirements of BS 4232, second Quality. The maximum amplitude of the blast cleaned surface shall not exceed 0.lmm.

Manual cleaning of structural steelwork including mechanical wire brushing, chipping hammers, vibratory needle guns and the like shall not be permitted except for small parts and then only with the prior written permission of the Engineer.

Surfaces shall be painted with the specified primer paint within four hours of having been blast cleaned.

As soon as the first undercoat has dried, a further stripe coat of paint shall be applied by brush to all edges, corners, crevices, exposed parts of bolts, rivet heads and welds. The stripe coat should have the same specification as the undercoat but be a contrasting shade.

Painted surfaces shall be cleaned of dust immediately prior to the application of further paint. All loose paint, dirt and grit shall be removed and areas contaminated with oil and grease shall be cleaned with emulsion cleaners followed by washing and rinsing· with clean fresh water and followed to dry thoroughly before paint is applied.

In the case of painted steelwork where the interfaces of HSFG bolts are bare steel, the primer coat shall be taken between 100mm and 20mm inside the perimeter of the joint area.

Where paints are to be applied to parent surfaces before making of a joint they shall be stepped back at 30mm intervals commencing at 80mm from welded joints and 100mm from the perimeter of all other joints.

All bolted joints shall be sealed against the ingress of water. Gaps at joints shall be plugged with approved filler and the perimeter of all joints shall be sealed with subsequent coats of paint.

All joints, welds and surfaces affected by welding shall receive the same protective system as applied to the parent surfaces.

Within 14 days of a joint being made and accepted by the Engineer, the parent material, exposed parts of bolts, nuts and washers, weld and affected areas shall be prepared and painted.

7.11 Painting

All paint used in the Works shall be subject to the approval of the Engineer.

All paint shall be supplied from the store to the painters ready for application. Any addition of thinners must be made in the store under the supervision of the Engineer and only as permitted by the manufacturer's data sheet. All the requirements of the manufacturer's data sheet shall be strictly complied with.

Paint shall be applied only to surfaces which have been prepared and cleaned in accordance with the requirements of Clause 6.10 of this specification.

The use of rollers shall not be permitted for the application of paint.

Paint shall not be applied under any of the following conditions: -

(a) When the ambient temperature is less than 4"C.

(b) When the relative humidity is greater than 90%.

(c) During fog, rain or mist.

(d) When any moisture is present or likely to condense on the steel. Each coat of paint shall be free from surface defects.

Successive coats of paint shall have different shades for identification.

The Contractor shall ensure that the proposed application rates shall enable the specified minimum dry film thickness to be achieved. If the total dry film thickness is less than the specified minimum, an extra finishing coat or coats shall be ·applied until the specified dry film thickness is obtained.

7.12 Paint Systems

The paint system to be used on structural steel work shall be as specified in the Special. Specification.

7.13 Damaged Surfaces

Any areas of paint which have been damaged following application shall be cleaned down to bare metal and the full specified painting system shall be re-applied. The new paint shall overlap the existing paint by at least 50mm all round the affected area.

Galvanized surfaces damaged shall be repaired either by the use of low melting point zinc alloy repair rods or powders made specifically for this purpose or by the use of at least two coats of a good quality zinc rich paint to BS 4652.

7.14 Internal Bracings and Brackets:

Internal bracings and brackets shall be designed to ensure the strength, rigidity and absolute uniformity of each tank depending on sizes.

7.15 Fasteners:

All bolts used in the assembly of the tank shall be of High Tensile Grade 9.8 for rigid holding. They shall be zinc coated to protect against any rust forming.

7.16 Joint Materials:

A non-toxic strip joining material shall be used between the flanges of tank plates, under the internal brackets and for sealing the cover plates to make all joints completely leak proof.

7.17 Fittings:

The Steel tank shall be provided with suitable standard nozzles either threaded or flanged depending on the requirements. Sizes and orientations are to be provided by the time of ordering.

The tank shall be provided with Inlet, Outlet, Overflow, Drain Vent, Level Indicators and Internal & External Ladder. Any other additional fittings shall be provided on request.

7.18 Measurement And Payment

(a) Item: Structural Steelwork

Unit: tonne

Structural steelwork shall be measured by the tonne and shall be the weight calculated from the approved shop drawings excluding bolts, welds, washers and all other fixings required. No deduction shall ·be made in the measurement for splay cuts, notches and holes providing that the area of each is less than 0.1 square meters. No allowances shall be made in the measurement for rolling margin or cutting to waste. The density of steel shall be taken as 7850 kilogrammes per cubic metre.

The rate for structural steelwork shall include for the cost of the following:-

(i) Design, submission of orders, fabrication drawings, details, calculations and certificates.

(ii) Provision of all structural steelwork, materials, bolts, nuts, washers , welding rods , and all other fixings; fabrication, including drilling, machining and welding; testing of welds and welders.

(iii) Temporary erection at the fabrication works for inspection by the Engineer.

(iv) Surface preparation, painting with specified paint system. (v) Inspection, and submission of test reports and certificates.

(vi) Marking, handling, packing, transporting and storage.

(vii) Erection, bolting, welding, including temporary bracings, guys, and craneage.

(viii) Complying with all the requirements of Section 6 of this Specification.

8. PIPEWORKS

8.1 Materials

All pipes, couplings, gaskets, lubricants, seals, coupling machinery etc., necessary for the proper construction of the pipe works as detailed in the Bill of Quantities and drawings shall be supplied by the Contractor.

The Contractor shall be responsible for ensuring that the pipes, couplings and other fittings laid or installed on each section of the work are of the standard and pressure classification specified as appropriate to the circumstances, and are manufactured of the specified materials.

The Engineer reserves his right to refuse any materials that in his opinion is inferior.

The Engineer has the right to test any material upon delivery, and materials found defective shall be replaced forthwith by the Contractor.

If the Contractor procures materials of different specifications in respect of flanges and threads etc. (imperial units-metric units), he shall at his own cost provide all adaptors and other fittings necessary to make connections to the satisfaction of the Engineer.

All materials shall be marked as specified in the relevant current British or ISO Standards for easy identification on site.

Pipes shall be supplied in standard lengths unless otherwise shown on the Drawings.

Specials shall be fabricated to the details shown on the Drawings, using, where applicable, the same materials, welding procedures and protective linings and coatings as are specified for the corresponding straight pipes.

Satisfactory temporary end covers shall be provided for the protection of threads, flanges and the prepared ends of pipes, fittings and specials, and for the prevention of damage to internal linings during transportation and during handling on Site.

8.2 Handling and Storing Materials

The method of transportation, handling and storing of pipes and fittings shall be in accordance with the manufacturer’s recommendations.

Pipes, valves, specials and other materials shall be handled, moved, lifted or lowered with the least possible impact. Handling equipment shall be of approved type. In slinging pipes only flat slings shall be used and the use of chain slings, hooks or other devices working on scissors or grab principles shall not be permitted. Pipes shall be slung from two or more points as the engineer may direct and the slinging, lifting and lowering shall be in the hands of a competent and experienced man.

Subject to the requirements of inspection before acceptance, protective bolsters, caps or discs on the ends of flanges or pipes or specials shall not be removed until the pipes or specials are about to be lowered into the trench. Every precaution shall be taken to prevent damage to internal Linings or external coatings.

Pipes in storage shall be supported clear of the ground on approved supports and adequately braced to prevent rolling. They shall not be stacked more than four tiers

high without the approval of the engineer. Materials of different classification shall be stored separately.

All pipes and associated material shall at all times be protected from sun and weather to the satisfaction of the Engineer.

The spindle shall not be used lift the valves.

No valves, fittings or specials shall be stacked more than one tier high without the permission of the Engineer, and they shall not be stored in a dirty place or condition and shall not be allowed to become embedded in earth, sand, stone, aggregate, water, fuel, or any other deleterious matter. Great care shall be taken at all times to keep the faces and seats of all valves clean and free from dirt and grit of any kind. No valve shall be closed without at first wiping the faces with a clean cloth dipped in clean oil. The cavity beneath the valve doors shall be thoroughly cleaned by hand. In the event of accidental spilling of bitumen, cement or other matter, they shall be either dissolved or carefully removed by methods that do not involve scraping of the faces.

Valves and their ancillary equipment shall be protected before and after erection against collapse of earthworks, falls of materials, concrete and cement droppings, wood and other matter.

Shortly before laying or fixing any valve, pipe or fitting the Contractor shall in the presence of the Engineer or his representative carefully examine each valve, pipe and fitting to ascertain damage or defect occasioned to the valves, pipes and fittings during loading, unloading, handling, storage and transportation. All damage and all defects revealed by this examination shall be repaired and remedied by the Contractor.

8.3 Laying and Jointing,

8.3.1 Pipes and Fittings

All laying and Jointing of pipes except jointing of PVC and Heavy Duty Polyethylene(HDPE) pipes shall be in conformity with CP 310 and CP 2010.

The bottom of the trench or surface of the bed shall be finished to a smooth even surface at the correct level to permit the barrel of the pipe to rest on the surface throughout its whole length between joint and sling holes. If considered necessary by the engineer, fine screened material shall be placed and consolidated in the trench bottom to provide such a bed.

In general the preparation of the trench bottom and bed shall be completed for a length of one pipe in advance of the pipe-laying.

The bottom of the trench and pipe bed shall be inspected by the engineer and only when passed as satisfactory shall pipe laying commence.

Each pipe shall be laid accurately to line, level and gradient so that except where otherwise directed, the finished pipe line shall be in a straight line both in horizontal and vertical plans.

The levels and gradients shown on the drawings shall be rigidly adhered to unless otherwise ordered by the Engineer.

Where lines of pipes are to be constructed the Contractor shall provide and fix, at such points as may be directed properly painted and securely positioned sight rails,

the levels and positions of which shall be examined and checked by the Engineer before the rails are used and as often thereafter as may be necessary.

There shall at no time be less than three sight rails in position on each length of pipeline under construction to any one gradient, and the sight rails shall be situated vertically above the line of pipes, or immediately adjacent thereto.

Pipes shall be lowered singly into the trench, brought to the correct alignment and inclination bedded throughout their length, and properly jointed strictly in accordance with the manufacturer's instructions.

Notwithstanding any flexibility provided in pipe joints, pipes must be securely positioned to prevent movement during and after the making of a joint. On screw and socket joints threads shall be coated with an approved tape to ensure water tightness.

Long radius curves in the pipeline shall be negotiated by deflections taken up in the joints or pipes of one or more lengths of pipes. The deflection at each of the various types of joint of pipes used in the works shall not exceed the manufacturer's specifications.

The Contractor shall take care that all pipes and couplings are clean and free of foreign matter before subsequent sections are jointed.

The Contractor shall obtain from the manufacturer or other approved supplier the necessary tackle required for the proper jointing of the pipes.

The Contractor shall make himself and his employees acquainted with and comply with the instructions issued by the manufacturers of the various types of proprietary joints and couplings for incorporation in the works. The Contractor shall be responsible for obtaining copies of such instructions.

No person shall be employed on the jointing of pipes that is not thoroughly experienced and skilled in the particular work in hand.

Pipes shall not be cut without the permission of the Engineer.

The cut shall be made with an approved mechanical pipe cutter and the edges of the cut shall be clean true and square. Threading of steel pipes shall be done with an approved device.

The normal continuity of construction may have to be interrupted at joints on the pipelines pending the delivery of certain valves or specials. The exact extent of the temporary gap to be left in such instances shall be predetermined, but shall not be fixed without reference to the Engineer to whom the Contractor shall submit for approval a sketch with dimensions showing details of the pipe and jointing arrangement to be adopted to effect ultimate closure. Special care shall be exercised to preserve the accurate alignment of the pipeline over the extent of the temporary gaps which it may be necessary to leave.

Subject to the permission of the Engineer, pipes shall be covered over with approved fill material upon successful completion of laying and joining. Joints shall be left exposed until completion of the pressure test.

Fill for surrounding and cushioning shall consist of uniformly readily compactable material free from tree roots, vegetable matter, building rubbish and excluding clay lumps retained on a 75 mm sieve and stone retained on a 25 mm sieve.

The materials for bedding shall, where ordered, consist of suitable selected materials obtained from the excavations or from approved borrow pits and transported to the location where they are required.

Adequate precautions shall be taken by way of back-filling or other means to anchor each pipe securely to prevent floatation of the pipeline in the event of the trench being flooded or during concreting.

Upon successful completion of the pressure test the pipeline shall be back-filled as specified.

8.3.2 Valves and Specials

Unless otherwise directed all valves, flow-meters, fittings and specials shall be individually supported and their weight shall not be borne by the pipeline, joints or couplings etc.

All supports for valves and fittings shall be of concrete Class 20 or as specified on the drawings.

Where air valves are to be placed the Contractor shall ensure that the highest point in the main is determined by levelling instrument.

Air valves shall be checked before the main is charged to ensure that the balls and faces are not scored or split, and that there is no dirt or other deleterious materials in the cavities of the body. All air nozzles shall be probed to see that they are clear. No air valve shall be stored before erection in the open in sunlight, or upside down to expose the balls and air cavities.

Scour valves shall be installed at low points in the pipelines as shown on the Drawings. The Contractor shall be in agreement with the Engineer on the exact position of scour valves in particular situations.

Scour valves shall, where possible, discharge in the direction of natural drainage and at such a distance from the Works as to preclude erosion effects.

Unless otherwise directed the controlling valve for a scour shall be installed not more than 1.5 m from the main pipeline.

Ends of all scours shall be protected from intrusion of animals and other foreign matter by suitable screening securely fixed to the pipe end.

Valve penstocks and other fittings shall be securely fixed and where required extension spindles and headstocks shall be properly aligned and fixed in a vertical position unless otherwise directed. They shall be tested for ease of operation and water tightness and valve lands shall be repacked where necessary. Any damaged protective coating shall be made good and they shall be left clean in all respects.

Before each valve is put into service all gears, bearings and spindles shall be oiled with approved oil as recommended by the valve manufacturer. Oil baths shall be topped up to the appropriate levels and all grease nipples charged with grease of approved manufacturer. No deleterious matter shall be allowed to come Into contact with the working faces and oil sumps shall be maintained clean.

All valves, fittings, specials shall be fixed with proper sealing tube, gaskets, washers etc. as necessary to the satisfaction of the Engineer.

The rates in the Bills of Quantities shall cover for the supply, storing handling installation and Jointing, together with all bolts, washers, gaskets and lubricants etc.

8.4 Pipes and fittings

8.4.1 Flanges

Where flanged joints are used, flanges shall be in accordance with the requirements of BS 4504: part I or BS 4622 or BS 4772.

The minimum pressure rating shall be for a working pressure of 1.6N/mm^2 (approximately 160 metres head) corresponding to NP 16 flanges. The hydraulic test pressure shall not exceed 3.0N/mm^2

The number of holes shall be as follows:

Diameter(mm)	**No of holes**
80 – 150	8
200 – 300	12
350 – 400	16
450 – 600	20
650 – 800	20

Flanges in pipelines with higher pressure rating shall be for a working pressure of 3.0 N/mm^2 (approximately 300 metres head) corresponding to NP 30 flanges. The hydraulic test pressure shall not exceed 4.0 N/mm^2.

Bolts, nuts and washers shall comply with the requirements of BS 4190 and BS 4320. Gaskets shall fulfil the requirements of BS 2494 and shall have a minimum thickness of 2 mm.

8.4.2 Ductile Iron

Ductile iron pipes and fittings shall comply with BS 4772 or ISO 2531, and pipeline distribution network shall be as per CP 2010 Part 3. The pressure rating of the pipes shall be for a minimum working pressure of 2.5 N/mm^2 (approximately 250 metres head) and a hydraulic test pressure of 3.0 N/mm^2. Care should be taken when the pressure test is carried out not to exceed the permissible test pressure for the fittings installed.

Joint shall be either "Tyton", "Stanlock", "Viking Johnson" of flanged joints as specified in the drawings and the Bills of Quantities. Before any other joint is used written approval of the Engineer must be obtained.

Pipes and fittings shall be coated inside and outside with a hot material complying with the requirements of BS 4147, type 1, grade-d, or with a cold applied material complying with BS 3416: Type II material.

8.4.3 Grey-Iron or Cast Iron

Grey iron or cast iron pipes and fittings shall comply with BS 4622 or ISO/R 13. The pressure rating of the pipes shall be for a minimum working pressure of

1.0N/mm^2 (approximately 100 metres head) and a hydraulic test pressure of 1.6 N/mm^2 Joints, internal and external coatings to be as specified in under the clause of Ductile iron.

8.4.4 Steel pipes

The steel pipe shall conform to B.S. 534 1981, B.S 1387, BS 3600 and BS 3601 and pipeline distribution shall be as per CP 2010 part 2, 1970 and unless otherwise stated specials shall be made from pipes that have been manufactured and tested in accordance with B.S. 3601. Joints shall be screwed and socket for nominal diameters upto 50 mm and flanged or socketed for nominal diameter above 50 mm unless otherwise stated. The type of joint used shall be to the approval of the engineer. The Pipes and specials shall be protected from corrosion internally and externally complying with the requirements of BS 539.The type of protection used shall be to the approval of Engineer.

Welds shall be inspected by radioactive non-destructive testing and tensile and weld bend tests as per BS EN 10224.

Steel Tubes and tubulars with screwed and socket joints shall be covered by the requirements of BS 1387.

Flanges shall be as specified in Clause 7.4.1 and threads as specified in BS 21.

8.4.5 Unplasticized Polyvinyl Chloride Pipes

All PVC pipes and fittings shall comply with KS 06-149:1981, ISO 161/1-1976 (E) or BS 3505.

Pipes indicated with a pressure class shall conform to the following minimum working pressures

Class 0.6 MPa- 0.6 N/mm^2 (marking: red) (KS classification: A

Class 0.9 MPa- 0.9 N/mm^2 (marking: blue) (KS classification: B)

Class 1.2 MPa- 1.2 N/mm^2 (marking: green) (KS classification: C)

Class 1.5 MPa- 1.5 N/mm^2 (marking: brown) (KS classification :D)

All fittings shall be of pressure class 1.5 MPa and be manufactured of cast iron, PVC or steel.

Joints to be Solvent Cement Joints for nominal sizes equal to or smaller than 50mm and mechanical joints (rubber ring) for nominal sizes equal to or bigger than 80 mm.

For both types of joints the manufacturer's jointing instructions, shall be strictly adhered to.

For solvent cement joints it is essential that the solvent cement used is the correct type, i.e. it shall be purchased from the same factory which delivers the pipes.

The rubber ring joints can be either the Polva type, which incorporates only one rubber ring or loose couplers with two rubber rings. In any case the fittings used shall be purchased from the same factory which delivers the pipes.

If the joint is difficult to fix the manufacturer should be consulted immediately. No cutting or scraping in any of the joints components shall take place.

PVC pipes and fittings shall be stored under cover, which fully protects the material from sunlight.

Acceptable nominal pipe diameters for PVC pressure pipes are 75 mm, 90 mm, 110 mm, 160 mm, 200 mm, 250 mm and 315 mm. 75 mm diameters shall only be allowed when a network analyses shows that the water demand for firefighting is satisfied.

All PVC pipes and fittings shall, prior to delivery, be factory-tested to 4.2 times the specified working pressure, and a certificate to this effect shall accompany all deliveries. PVC products shall be stored away from sunlight and shall be backfilled as soon as practicable after having been laid.

8.4.6 Precast Concrete

Precast concrete pipes and fittings shall comply with BS 556: Part 2.

The laying and jointing of the pipes shall comply with CP 301.

The Contractor shall adopt such measures as may be approved by the Engineer to ensure that every newly laid pipe is concentric with previously laid pipes with which it joins.

Unless otherwise approved by the Engineer pipes shall be laid in an upstream direction and the socket ends shall point upstream.

Before commencing the laying operation the Contractor shall ensure that the parts of pipe which will come into contact with the jointing material are perfectly clean.

Cement mortar joints for spigot and socket pipes shall be made as follows:-

(1) Before commencing the jointing operation, the socket of the previously placed pipe and the spigot of the new pipe shall be cleaned and thoroughly soaked with water.

(2) The spigot shall be wrapped one complete lap with tarred hempen spun yarn and the new pipe shall be carefully drawn towards the previously laid pipe so the spigot enters tie full depth into the socket of the previously laid pipe. The new pipe shall then be adjusted and fixed in its correct position in line, level and gradient and the tarred yarn shall be sealed tightly into the socket.

On completion of this operation, the yarn shall not fill more than one quarter of -the total depth of the socket.

(3) The remainder of the socket shall be completely filled with cement mortar consisting of one part of cement to three parts of sand. The mortar filling shall terminate flush with the socket and shall be neatly trowelled to a smooth finish around the pipe.

To assist the curing of the mortar the contractor shall cover the joints immediately after they are made with a layer of Hessian cloth which shall be kept continuously wet during daylight hours and he shall further adopt such other measures as the Engineer may direct

Provided the Contractor has the Engineer’s written consent other means of jointing may be adopted, e.g., rubber ring-joints. The Engineer’s instructions in regard to other jointing materials must be strictly complied with.

8.4.7 Glass Reinforced Polyester Pipes (GRP)

The GRP pipes shall be of International Standards Organization ISO 10639 and EN 1796 for potable water transfer. Joint testing shall meet ASTM D4161 AND EN 119 Standards. Long Term Stiffness shall meet ISO 10468 and Long Term Bending shall meet ASTM D5365 Standards. Production of GRP pipes shall be through controlled manual process to ensure high quality pipes.

8.4.8 High Density Polyethylene Pipes (HDPE)

The (HDPE) pipes shall be of International Standards Organization ISO 4427 and BS 6437 & 6730 for Potable water Stress Regression Tests to comply with ASTM D 2837. Density 955kg/ m^3, pipe classes and markings shall correspond to those of uPVC pipes. Pressure testing shall be as per manufacturer's recommendation and as approved by the Engineer. All transitions from HDPE pipe to GI, Steel, uPVC or Cast Iron shall be as per manufacturer's recommendation and to the approval of the Engineer

Acceptable nominal pipe diameters for HDPE high pressure pipes are 25 mm, 40 mm, 50 mm, 63 mm, 75 mm and 90 mm. Under no circumstances may saddles be used with PE pipes. Welded adaptors may also not be used with PE pressure pipes.

8.5 Protection of Pipes

The concrete used for bedding, haunching and surrounding the pipes shall be concrete class 15 unless otherwise ordered by the Engineer. The concrete protection shall have total dimensions not less than those given below.

The various types of concrete protection to pipelines are detailed below:

(i) Bedding concrete shall have a width of at least 300 mm bigger than the external diameter of the pipe and shall support at least the bottom quarter of the pipe circumference. It shall have a minimum depth of 100mm measured under the pipe throughout the cross-section.

(ii) Bedding and haunching shall comprise a concrete bed with a minimum width of 300mm more than the external diameter of pipe and a minimum thickness of 150mm below the pipe, and haunching with a minimum thickness of 150 mm on both sides the pipe. The top of the haunching to be flush with the top the pipe.

(iii) Surrounding concrete shall comprise a concrete bed as described above together with 150 mm concrete on both sides and on to the pipe, giving a pipe protection of at least 150 mm concrete everywhere around the pipe.

Concreting of bedding, haunching or surround shall not be done until the pipes have been jointed, inspected and tested. The concrete shall be placed on one side of the pipe only until the flow of material under the weight placed ensures that the concrete is in full contact with underside of the barrel of the pipe throughout its length. The concrete shall be placed in one operation and shall be well worked to a homogeneous mass. The pipe shall be carefully anchored against floatation. All anchorage, haunches, surrounds, etc. shall be placed on and against undisturbed earth or rock as directed by the Engineer.

PVC pipes are laid in suitable bedding material as per drawings. Protection against e.g. load from traffic is carried out by laying of concrete slabs as detailed on the

drawings. Special care shall be taken regarding compaction of fill below the concrete slabs.

8.6 Valves and Specials

Where flanged joints are used, flanges shall be specified in clause 7.4.1

Where screwed joints are used, thread shall be complying with BS 21.

Joints shall be flanged for sizes equal to or bigger than nominal diameter 80mm and screwed for small sizes.

The names of manufacturers and the specifications of the products offered shall be provided at the time of tender.

8.6.1 Gate Valves and Sluice Valves

Gate (sluice) valves shall comply with BS 5163.

The valves offered shall be with straight through openings and shall be with double faced cast iron wedges and have two machined gunmetal faces securely fixed into machined recesses.

The body of the valves shall withstand a pressure equal to or greater than the test pressure of the line and the valve seat shall withstand pressure equal to or greater than the working pressure of the pipeline. All gate valves and sluice valves installed in sections of the pipeline having a working pressure below 1 N/mm^2 shall have a rating of PN 10 (100 metres head). Valves installed in sections of pipeline having a working pressure between I N/mm^2 and 1.6 N/mm^2 shall be valves with a rating of PN 16.

For pipelines having working pressure higher than 1.6 N/mm^2 BS 5151 shall apply.

Materials shall be Cast Iron for sizes equal to or bigger than 0 80 mm, with flanged joints, and Cast Iron or brass for smaller sizes with screwed joints.

The valves shall be with nourishing spindle and shall if not otherwise stated be supplied with handwheels.

Handwheels shall be of cast iron, and shall have cast on the upper s;-d of the rim, words "OPEN" with appropriate direction arrows.

8.6.2 Butterfly-Valves

Butterfly valves shall comply with BS 5155. The valves shall be of the ”T light shut-off type" and shall be of either the double flanged or the wafer types with metal-to-metal seating.

The minimum service rating shall be PN 2.5. Care shall be taken when installing wafer type butterfly valves to ensure that the door when open does not foul the connecting pipe bore Dr any other- adjacently connected valve or fitting.

The valves shall be lever operated and shall be marked with arrows showing “Open" and "Closed" positions.

Where the valve is mounted in a horizontal pipe with the shaft horizontal, it should be fitted in the pipeline so that the 1ower portion of disc moves in the same direction as the flow when opening the valve.

8.6.3 Non-Return Valves (Reflux or Check Valves)

The valves shall comply with BS 5153, and shall be of the swing pattern type.

The pressure rating shall be NP 16 corresponding to a working pressure of 1.6 N/mm^2 (160 metres head). Material to be Mechanite Iron or Cast Iron for sizes equal to or bigger than 40mm, and Bronze or Brass for smaller sizes.

The valves shall be installed, on horizontal parts of the pipelines, and shall have an external indication of the direction of flow.

8.6.4 Air-Valves (Small-Orifice)

Standard small orifice type with inlet ferrule screwed 25mm BSP taper male e.g. M/S Neptune Glenfield cat. No. 1250 with an outlet orifice diameter of 2.25 mm and an operating pressure not less than 1.6 N/mm^2 (16 bar).

For pipelines having working pressures higher than 1.6 N/mm^2 the valves shall have an operating pressure of not less than 2.5 N/mm^2 (250-m head).

8.6.5 Air-Valves (Large-orifice and double acting)

Double large orifice air valves as Glenfield cat. no 1271 shall be manufactured of cast iron and shall have a minimum nominal diameter of the inlet of 80 mm. Working pressure shall be not less than 1.6 N/mm^2 (160 m head).

For pipelines having working pressures higher than 1.6 N/mm2 the valves shall have an operating pressure of not less than 2.5 N/mm^2 (250 -head).

8.6.6 Float-Valves

Working Pressure to be minimum 1.0 N/mm^2 (100-m head) if not otherwise specified on the drawings and in the Bill of quantities.

Capacities and dimensions to be as specified on the drawings.

Dimensions indicated are the diameters of the inlet to the float valve.

Types: Portsmouth screwed 15 to 50 mm) (BS 1212)

Single or Double Beat Equilibrium Angular, flanged(50 to 150 mm)

8.6.7 Constant Flow Valves

Constant Flow Valves or flow regulators are to be of flexible orifice type or other approved type with an accuracy of discharge flow of plus or minus 10% of the nominal flowrate, at least up to a pressure of 1 N/mm^2 flow rates to be as shown on drawings,

8.7 Main-Water meters

Woltmann type with metric clock type registration supplied with blank cover to replace mechanism. Ends to be flanged. Where reducers (tapers) are required, special reducers which provide identical overall lengths for varying sizes of meters to be used.

8.8 Penstocks or Sluice Gates

Penstocks shall be single faced cast iron gates with non-rising spindle complete with extension spindle and removable handwheel all of approved manufacture.

8.9 Draw-off taps and Stop valves

All draw-off taps (bib-taps, hose-taps etc.) shall comply with BS 1010, and shall be made of brass.

If specified in the drawings or Bills of Quantities the taps shall be chromium plated.

8.10 Auxiliary Works

All works specified in this clause shall be with materials and workmanship as specified in Section 3: Builders Works.

8.10.1 Valve Chambers

Unless otherwise directed or detailed all valves, meters and other mechanical fittings shall be housed in chambers with lockable covers.

Valve work shall be so placed in chambers as to facilitate operation, meter reading etc. through the cover opening.

Chambers are measured in numbers and shall be priced as lump sum items covering all composite work as specified on the drawings inclusive of excavation in excess of trench excavation, concrete supports or valves, anchoring walls and backfilling around the chambers.

The depths stated on the drawings are normal depths. Actual depths depend on depth of pipes.

8.10.2 Thrust blocks and Anchors

If not instructed to do otherwise the Contractor shall provide thrust blocks at all bends, tees, ends and wherever shown on the drawings.

Enlargements shall be excavated in sides and bottom of the trench to accommodate anchorages and thrust blocks.

Concrete thrust and anchor blocks shall be formed in accordance with the typical sections shown on the Drawings or as directed by the Engineer. The additional excavation shall be made 'after the bends etc. have been jointed and the concrete shall be placed immediately after the completion of the excavation.

The back of supports and blocks shall abut on to solid ground, all loose material being removed before Concreting.

The concrete used for thrust and anchor blocks shall be of Grade 20 and shall after Placing be kept in view for not less than six hours. No pressure shall be applied in any section of mains until the concrete has cured at least three days.

All PVC material shall be wrapped with two layers of bituminous felt for the entire length in contact with concrete. Thrust blocks are measured in numbers and shall be priced as lump sum items covering all necessary works and materials together with excavation, backfilling and formwork.

Anchoring walls for valves are parts of the valve chambers and are included in the lump sum for valve chambers.

8.10.3 Road-Crossing

When the contractor encounters a road where a road crossing is indicated on the drawings or where to his opinion, such a crossing is required, he shall immediately

inform the Engineer. On receipt of the above information, the Engineer will issue appropriate instructions.

8.10.4 Painting

Painting and other protection of the external and internal surfaces shall be in accordance with, manufacturer's recommendations or as specified in Section 5 of these Specifications.

8.11 Testing of Pressure Mains

Pressure pipelines (together with all specials and valves incorporated in the mains) shall, before being covered, be tested with water as specified in CP 310.

At least two days' notice must be given in writing to the Engineer before pressure testing is commenced.

8.12 Water Pressure Test

The water test pressure to be applied will be 1.5 times the nominal working pressure for the class or pipe being tested. The Engineer however, reserves the rights to alter this figure.

Pressure testing of pipelines is not allowed against a closed valve. Mains shall be filled and tested in section of convenient lengths, which must not exceed 500 metres. Where pipes are laid with steep gradients the length of pipes tested at any one time shall, be as directed by the Engineer.

The ends of pipes under test shall be closed by means of caps or blank flanges provided by the Contractor. Gate valves must not be used for this purpose. All scour valves and air valves shall be replaced by blank flanges before commencement of the test.

After laying, jointing and anchoring, the main should be slowly and carefully charged with water so that all air is expelled, allowed to stand full for several days and then be tested under pressure. The test pressure shall be applied by means of a manually-operated test pump connected to the main and to two parallel installed pressure gauges calibrated at an approved testing laboratory. The test pressure shall be maintained for five hours, and if there is any leakage, it shall be measured by the quantity of water pumped into the main in order to maintain the test pressure.

The permissible leakage of water which is given in imperial units in CP 310 as 0.0375 litres per mm diameter per 1000 m length per 24 hours per 10m head of water.

The above maximum permissible leakage approximately corresponds to the following quantities of water over 100 length of pipe and 100m head 1 N/mm^2).

Nominal diameter	Maximum amount of water Pumped of per hour at 100 m head per 100m length of pipe.
	litres
θ50-mm	0.08
θ80-mm	0.12

θ100mm	0. 16
θ150mm	0.24
θ200mm	0.31
θ250mm	0.40
θ300mm	0.48

Should leakage of water occur at the joints, the joint shall be reassembled to eliminate such leakage or, should this not prove possible, the contractor shall supply and assemble new joints. Should any pipe or joint burst or should water leak or weep through the body of a pipe or joint the contractor shall forthwith remove the faulty pipe or joint and replace it with an un-faulty pipe or joint. In all above cases, the length under test shall be retested as above described and the process repeated, if necessary, until the pipeline satisfactorily withstands the prescribed test

The Contractor shall provide labour, install and work the test pump, pressure gauges and all other equipment required for the rest, and he shall fill the pipes with water and subsequently emotion them after the test, all to the approval of the Engineer. Water drained from the pipes shall be discharged in a way that does not affect the stability of the Works or adjacent structures.

The Contractor shall allow for all expenses in connection with testing in his rates for pipe laying.

8.13 Testing of Distribution System

If required by the Engineer the Contractor shall carry out and/or assist with the testing of the completed distribution system as directed by the Engineer in order to establish the flow characteristic of the pipelines as built.

The Contractor shall provide all transport, labour and other assistance requested by the Engineer, and the Contractor shall take delivery, install, remove and make good in connection with the installation of gauges and meters etc. for the purpose of the test.

8.14 Testing-of Sewer Pipes

All pipes and fittings shall be tested before being backfilled. The lines shall be tested in lengths between manholes or such shorter lengths as the Engineer may approve and in all cases the tests shall applied in the presence and to the satisfaction of the Engineer or his representative.

The testing shall be carried out as specified in CP301.

The requirements of CP301 correspond to the amounts of water indicated below.

Nominal diameter	maximum amount of water added per diameter of pipe 30 min. per 100 m length of pipe

θ100 mm	3.0 litres
θ150 mm	4.5 litres
θ230mm	7.0 litres

Any length of pipeline which is found to be defective shall immediately be put in a sound and satisfactory Condition by repairing any defective part or if necessary by relaying whole of the defective length and again testing and so on until the test is satisfactory .Any pipe found to be partly or totally cracked after laying shall be replaced by another, unless the engineer approves the adoption of an alternative method of repair.

If the Engineer suspects that a pipeline has been damaged during concreting or backfilling, he may order the Contractor to re-test the suspected length. Should the re-test indicate that the line is no longer capable of withstanding the prescribed tests, the Contractor shall forthwith search for and repair the damage and re-test the pipeline until a satisfactory test is obtained.

All manholes must be constructed to be watertight. In general, manholes will be inspected visually and not be tested, but the Engineer reserves his right to direct the Contractor to test the manholes before backfilling the surrounding excavation in order that any necessary works of repair may be carried out prior to backfilling. Any such tests shall be carried out in accordance with such directions as the Engineer may issue.

The Contractor shall provide ample expanding stoppers for each diameter of pipe to be laid, together with such up stand tubes, U-tubes, pumps, labour and all required testing apparatus to the approval of the Engineer.

The Contractor shall be responsible for adequately strutting stoppers when pipelines are subjected to a water test, and he shall take adequate precautions to ensure against any stopper or strutting being carried into a downstream, pipe when the water is released.

The Contractor shall allow for all expenses in connection with testing in his rates for pipe laying.

8.15 Cleaning and Sterilization of Water supply pipes

The Contractor shall before handing over and during the Maintenance period clean pipelines, chambers and manholes for all dirt and rubbish.

All pipes shall be thoroughly cleaned and washed out to remove all contamination, and all water from these operations shall be removed and drained away.

Sterilization should be carried out in accordance with CP 310.'

Following the satisfactory cleansing the Contractor shall with the use of a portable dosage system - or by some other approved method introduce a solution of a sterilizing chemical containing chlorine into the pipeline. The solution shall be introduced at a very slow rate and shall be of such strength as to give a chlorine concentration of not less than 50ppm (parts per million) throughout the Length of the pipelines.

All taps on the distribution pipes shall be opened successively, working progressively away from the Place where the solution is introduced. Each tap shall be closed when the water discharged begins to smell of chlorine. The whole system shall then remain charged for 24 hours, after which a test shall be made for residual chlorine. If no residual chlorine is found, the sterilization process will have to be carried out again, until a satisfactory result is obtained. Finally, the pipes shall be thoroughly flushed out and recharged with supply water.

On completion of the sterilization process the pipes shall be left full of water.

The Contractor shall in his rates for pipe laying include all costs of labour, transport, materials, equipment, chemicals and water necessary for the satisfactory completion of the cleansing and sterilization operations.

8.16 Measurement and payments

a. Pipe- type and size

Unit: m

Different sizes and types pipes shall be measured in linear meter laid. The rate shall include the cost of providing; storing, handling, laying and jointing of pipes. The rates shall include for, cleansing and sterilizing all to the satisfaction of the engineer and complying with the required of clause 7.1 to Clause 7.15 of this specification.

b. Pipe appurtenances and auxiliary works including Anchor blocks and chambers

Unit: No.

Pipe appurtenances and auxiliary works shall be measured by numbers provided and installed. The rate shall include the cost of providing; storing, handling, fixing and constructing and jointing of appurtenances. The rates shall also include excavation, formworks, backfilling and requirements for complying with the required of clause 7.1 to Clause 7.15 of this specification.

9. EXTERNAL WORKS

All materials and workmanship not described in this section are deemed to comply to the relevant specifications of the work in hand contained in other sections of these specifications

9.1 Roads and Paved Areas

Work shall be carried out in accordance with the *Standard Specifications referred to in this document is the Standard Specification for Road and Bridge Construction, 1986 Edition published by the Ministry of Transport and Communications. This document shall form part of the Contract.*

9.2 Fencing

All fencing shall be erected in exact vertical position and to straight lines as shown on the drawings. The materials and workmanship shall comply with the recommendations in BS 1722.

9.3 Concrete Posts

Precast concrete posts shall be cast of concrete Grade 20 as specified in Section 4, to the sizes shown on the drawings.

The posts shall be securely placed in performed holes and cast in concrete to depth as shown on the drawings.

Bracings shall be provided at all corners, and at intervals of not more than 50 metres on straight lines of fencing. Maximum distance between posts is 4.5m concrete posts and bracings are measured in numbers, and the rate shall include for supply, excavation, erection and backfilling.

9.4 Chain Link

The chain link fencing shall be supplied in rolls of 2130mm (7 feet) width and shall be with 65mm mesh of 12 ½ gauge, fitted to 4 rows of line wires with binding wire at 130mm centres.

The cranked top of the posts shall be fitted with 3 strands of 12 ½ gauge barbed wire with four point barbs at 150mm centres. All members of the fencing shall be hot dip galvanized.

Fencing is measured in linear metres and the rate shall include all waste and cutting, as well as fixings to posts and all line wires, barbed wires and binding wires.

9.5 Gates

If not otherwise stated gates shall be 4 metres wide double leaf gates, made from 40mm galvanized steel tube frame (medium class) with 8 gauge galvanized weldmesh welded to the frame. Bracings, hinges, towerbolts and locking arrangement shall be as shown on the drawings or of other approved type. The top of the gates shall be fitted with 3 strands of 12 ½ gauge barbed wire. The price for the gate shall include for the manufacture, installation, all bolts and padlocks etc. and painting all as shown on the drawing. Gate posts made of rolled hollow square sections as shown on the drawings are measured separately.

9.6 Measurement and payments

Roadworks are measured as covered area in square metres. Lines of paving slabs and kerb stones are measured in linear metres, and the rates shall cover for all cutting, waste and bedding etc.

Fence shall be measured in linear meters constructed. And gates shall be measured in numbers.

10. MECHANICAL AND ELECTRICAL WORKS

10.1 General

The workmanship and materials covered by this section shall include the supply and installation of all pumps, motors, engines and chemical dosers and ancillary equipment.

All materials and equipment shall be obtained from reputable manufactures, who have well established agents in Kenya. The local agents shall be able to provide an efficient service of the equipment and must have ample stocks of all expendable items such as gaskets, filters, fuses, indicator lamps, coils etc.

The Engineer reserves his right to reject manufactures or agents not fulfilling the above requirements.

It is the responsibility of the Contractor to provide evidence that the equipment is in compliance with these specifications, and that the equipment will operate satisfactorily under the conditions under which it is installed. All equipment offered shall comprise a complete installation such as bolts, gaskets, protective screens, belt guards, exhausters, painting etc. all to the satisfaction of the Engineer.

Details of concrete plinths for pumps and motors shall be supplied by the Contractor at least 6 weeks before he intends to install the equipment for the approval of the Engineer.

10.2 Trade Names

Subject to the provision of the preceding paragraph and anything hereafter to the contrary trade names or manufacturer's catalogue numbers are mentioned in these Conditions, the reference is intended as a guide to the type of article or quality of material required. The Contractor may use any article or material equal to type or quality to those herein described subject to the prior approval of the Engineer and at his absolute discretion. The onus of proof as to equivalent quality will rest with the Contractor, whose Tender will be deemed to include for the makes described hereafter.

10.3 Spare Parts

The Contractor shall submit with his Tender a guarantee from the suppliers that he will hold a sufficient number of spare parts as recommended by the manufacturer for the maintenance of the equipment

10.4 Storage of Materials

The Contractor shall provide weather-proof lookable sheds for the safe storage and custody of materials for the Works and shall move such sheds and make good damaged of disturbed surfaces upon completion to the satisfaction of the Engineer.

10.5 Testing

The Engineer shall be entitled at all reasonable times during manufacture to inspect, examine and test on the Contractor's premises, the materials and workmanship of all Plant to be supplied under the Contract, and if part of the said Plant is being manufactured on other premises the Contractor shall obtain for the Engineer permission to inspect, examine and test as if the said Plant were being manufactured on the Contractor's premises. Such inspection, examination or testing if made shall not release the Contractor from any obligation under the Contract.

The Contractor shall carry out at his own expense any tests he may deem necessary to satisfy himself upon the quality of materials and workmanship.

Performance tests shall be carried out for all mechanical and electrical equipment to ensure that the equipment comply with the specifications.

The duration of the performance tests shall be 24 hours.

The Contractor shall include for the necessary labour and instruments, for carrying out these tests, and he shall be responsible for the discharge of water during tests.

The Contractor shall give the Engineer reasonable notice in writing of the date on and the place at which any Plant will be ready for testing as provided in the Contract. If the Engineer so desires to witness the testing the Contactor will facilitate necessary arrangements to enable the Engineer to attend.

The Contractor shall submit to the Engineer all the relevant manufacturers certified tests results and certificates for records.

10.6 Drawings

The Works shown on the drawings are for tendering purposes only and it is the Contractor's responsibility to provide detailed drawings of the works he proposes to use. It is the Contractor's responsibility to see that all openings, processes, channels, conduits etc. in the structures are so located and installed as to fit and function properly with the mechanical and electrical installations.

The Contractor shall include in his rates for the preparation of all necessary detail or workshop drawings required for the manufacture and erection of the installation and such drawings are to be submitted to the Engineer for approval prior to the commencement of manufacture or installation.

Upon completion of the Works the Contractor shall submit "as built" drawings to the Engineer for his approval.

The Contractor shall be responsible for any discrepancies, errors, or omissions in the drawings and other particulars supplied by him. If such discrepancies, errors, or omissions are due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer, The Employer shall be responsible. The Employer shall pay any extra cost reasonable incurred by the Contractor due to any alterations of the work necessitated by reason of inaccurate information so supplied to the Contractor.

10.7 Description of Services

The Contractor shall supply, transport, deliver, install, connect, commission and hand over all equipment and materials specified in the Specifications, Drawings and Bills of Quantities, in a clean, complete and in every detail working condition. He shall carry out all tests specified in these Specifications or in relevant British Standards together with any test which might be requested by the Engineer in connection with the use of special materials or equipment. Further more, the Contractor shall provide Guarantee, Initial Free Maintenance, instruction Manual and careful instruction to the Employer's staff.

Cost of all the aforementioned materials and services together with all necessary labour, overheads and profits, duties, sales tax, etc. shall be deemed to be included in the rates entered into the Bills of Quantities.

10.8 Maintenance

The Contractor has the liability for defects and maintains all works, equipment and electrical installations for a period of **twenty four** calendar months from the date that

the Works are handed over to the Employer. All expendable items, such as gaskets, filters, fuses, indicator lamps, relays, coils, switches, oils tests etc. are to be supplied by the Contractor.

In case permanent power supply is not made available in time for testing various equipment, the Contractor, if he intends to clear out the site, should make his own arrangement for testing the equipments and should again return to site for final testing when permanent power is made available.

No extra payment will be made for the above.

The Contractor shall be held responsible for and shall make good all defects in materials and workmanship that appear during the maintenance periods. The period of liability shall not end until all defects which appear during the defect notification period have been rectified.

In the event of equipment being out of operation due to breakdown for a duration exceeding one week, the defect notification period for that equipment will be extended with a period of the same duration.

10.9 Initial Maintenance Period

The Contractor shall during the twenty four months defect notification period carry out all necessary adjustments and repairs, cleaning and lubricating etc. A report of any work done shall be submitted to the Employer and incorporated in the maintenance records.

The Contractor shall inform the Employer before any routine maintenance inspections are carried out, so the Employer can have staff available to attend. Any item of material found to be defective shall be replaced by the Contractor within seven days of being notified and any results of defective workmanship shall be rectified including the supply of new parts if necessary.

The Contractor shall allow in his contract price for the maintenance and inspection service and shall provide for all labour, tools, instruments and plant and the transportation thereof, as required for the satisfactory execution of these obligations, and for the provision, use and installation of all materials such as oils, greases, etc. and parts which are periodically renewed such as relay contacts or parts which are faulty for any reason.

10.10 Maintenance and Servicing after Completion of the Initial defect notification Period

The Contractor shall if requested enter into a maintenance and service agreement with the Employer for a period of up to five years from the last day of the maintenance period. Such an agreement shall offer the same services specified above under “Initial defect notification Period”.

10.11 Maintenance Manual

Upon completion the Contractor shall furnish to the Engineer six copies of a manual containing all the following items:-

a. Description of equipment

b. Full operation and maintenance instructions

c. Valve operation

d. Fault-finding chart

e. Emergency procedure

f. Maintenance and service periods

g. Lubricating instruction

h. Colour code legend

i. Primary and secondary spares

j. Recording drawings

The manual shall be specifically written and not a standard manufacturer's manual unless approved by the Engineer.

Tags giving instructions are not sufficient. All instructions shall be written into the manual with reference to the drawings. All valves terminals and controls on the plant shall be labelled to correspond with the maintenance and operation manual.

The works shall not be considered to be complete for purpose of taking over until such instructions and drawings have been supplied to the Employer and approved by the Engineer.

10.12 Motors

All motors shall unless otherwise stated be suitable for 415/240 volts, 3 phases, 50 cycles, 4 wires power supply, and shall be executed for star-delta starters as specified.

The motors shall be constructed in accordance with CP 1015, and shall be protected as specified in section 11 – Electrical Works.

The motor speed shall not exceed 2900 R.P.M. low speed motor especially 1500 R.P.M shall be preferred.

The motor shall be foot mounted, squirrel caged, drip-proof, or totally enclosed suitable for an ambient temperature of 30^0 C, the motor shall be designed for continuous running. Each motor shall be capable of an overload of 10% above its rated output at the rated voltage for a period of one hour without sustaining damage.

The rated output of the motor shall be the maximum horsepower absorbed by the pump under the described condition of head and discharge, plus an allowance for loss of power in couplings etc.

Electrically driven pumps shall if not otherwise stated be directly couple via flexible couplings to the motors, and motors and pumps shall be fitted to common rigid steel frames bolted to concrete plinths.

Proper alignment of motor and pump must be guaranteed.

10.13 Generator

The generator shall be rated 400V, 50 HZ with a prime rating of 200 KVA and a stand by rating of 223 KVA

The applicable voltage range of 380 to 415 Volts and a speed of 1500 rpm, The Generator shall be obtained from reputable manufactures, who have well established agents in Kenya. The local agents shall be able to provide an efficient service of the equipment and must have ample stocks of all expendable items such as gaskets, filters, fuses, indicator lamps, coils etc.

The engines shall be of the diesel type with a maximum speed of 1500 R.P.M designed for continuous running.

The engines shall suitanble for electric start, couplings, tachometer, hand throttle control, hand stop control, silencer, fuel tank for at least 300 hours running of one of the engines and necessary tool kit for minor repair.

10.14 Pumps

The backwash and re-circulation pumps shall be gland packed cast iron horizontal centrifugal volute casing pump type each coupled with appropriately sized 3phase 1450rpm electrical motors by HRC coupling and mounted on a prefabricated steel base plates.

10.14.1 Backwash Water Pumps

Pump casings shall have interchangeable cast iron wear rings. The impellers shall be of bronze or high grade cast iron dynamically balanced to ensure smooth running. The impeller shaft shall of steel and fitted with renewable bronze protecting sleeves wherever it is in contact with the pumped water. Pumps shall use Gland Packing for seals, and gland packing for 2 years of operation shall be provided during commissioning. It shall be stated in the tender documents if other materials are offered.

10.14.2 Re-circulation Water Pumps

Pump casings shall have interchangeable cast iron wear rings. ***The impellers shall be semi open impellers suitable for pumping sludge***. The impellers shall be of bronze or high grade cast iron dynamically balanced to ensure smooth running. The impeller shaft shall of steel and fitted with renewable bronze protecting sleeves wherever it is in contact with the pumped water. Pumps shall use Gland Packing for seals, and gland packing for 2 years of operation shall be provided during commissioning. It shall be stated in the tender documents if other materials are offered.

The pumps will be installed in the pump house on concrete plinths and connected to electric power through a wall mountable control panel with switchgear that composes among others; star-delta starters, voltmeters, ammeters, phase failure protection, “ON-TRIP-OFF” indicator lamps, auto & manual “ON - OFF” selector switches.

All pipe types and size used in installation of the pumpsets shall be flanged, and prices shall include for the necessary tapers, gaskets, bolts, etc. for connecting up to the pipe diameters shown on the drawings.

The total efficiency of pump and motor shall be as high as possible and NPSH for pumps shall be as low as possible. The pump type and size shall be chosen so as to ensure that the pump is working with an efficiency of not less than 90% of the peak efficiency. Performance curves, efficiency curves and power demand curves shall accompany the Tender, with clear indicator of the capacity and efficiency for the pump with the specified head.

Operation of the pumps shall be 2 duty pumps and 1 stand-by.

The backwash pumps shall be capable of raising the water from the clear water tank to the elevated backwash water tank. The re-circulation pumps shall be capable of raising the water from the backwash water lagoons back to the water inlet chamber at the beginning of the water treatment works.

The backwash and re-circulation pumps shall be commissioned and handed over to the Engineer with 5 sets of operating instructions mannuals and 2 years worth of spares. The pump casings, bearings, shaft, impellers and gaskets must be executed of materials suitable for many years continuous operation in a water system. If materials other than cast iron, bronze or stainless steel are included in the pump, it cannot be approved unless a written guarantee for 10 years performance is produced, giving free replacement including labour in case of fault.

The pumps shall be of the following technical details:

Pump	**Q (m^3/hr)**	**Head (m)**	**Power (kW)**	**r.p.m**	**ph**
Recirculation Pumps	33	35	7.5	1450	3
Backwash Pump	48	45	11	1450	3

10.14.3 Design

The pumps comprise of a horizontal volute casing, single stage with power ratings and main dimensions to EN 733 up to DN 200. Shaft shall be replaceable shaft protecting sleeve in the shaft seal area. Volute casing and impeller shall have replaceable wear rings. Volute casing shall have an integrally cast pump feet. Bearings shall be deep groove ball bearings, grease lubricated.

The shaft seal shall be gland packing. Other features shall include: Surface cooled, three phase squirrel cage motor; IP 55 Enclosure; thermal class F with temperature sensors and 3 PTC resistors; HRC coupling; contact coupling guard as per EN 294 and a base plate that shall be sectional steel/ folded steel plate/ fabricated sectional steel for the complete unit (pump and motor) in torsion resistant design.

10.15 Chemical Dosing Equipment

The chemical dosing equipment shall consist of dosers, tubes and connections as shown on the drawings.

The type or principle of dosing shall be as per ProMinent's "Sigma/3 Control Type (S3Cb)" or of a similar approved type.

The prices entered in the Bills of Quantities shall cover for the complete installation (chemical tanks excepted). Any item not mentioned in the Bills of Quantities shall be deemed to be covered by the other rates.

Pump Details are as follows

	Delivery Rate at max back pressure	
Type of Pump	bar	l/h
Chlorine Dosing	7	500

Alum and Soda Ash	4	1,040

Chemical dosing rates shall be as follows:

Alum Dosing Pump – $1m^3/hr$

Soda ash Dosing Pump – $1m^3/hr$

Chlorine Dosing – $0.5m^3/hr$

10.16 Pressure Gauges

The pressure gauges shall be mounted on the delivery side of pumps. The gauges shall be in metric units complete with necessary fittings and isolating cock. The Gauges shall be fitted with dampening fluid.

10.17 Electrical Works

10.18 General

The quality of materials and workmanship specified in this section is for all items forming part of the electrical installation as shown in the Drawings, Bills of Quantities and this Specifications.

10.19 Regulations

All the Electrical Works shall be carried out strictly in accordance with the following:-

i) The 13th Edition of the "Regulations for the Electrical Equipment of Buildings" issued by the Institute of Electrical Engineers of Great Britain with Kenya amendments.

ii) The Licensee's By-Laws

iii) The Government Electrical Specification (G.E.S. No 1 and No. 2).

iv) The Power Act

v) Relevant British Standard Specifications and Codes of Practice published by the British Institution (hereafter referred to as BS and GP, respectively).

vi) The Specifications

vii) The Contract Drawings and the working drawings, produced by the Contractor and approved by the Engineer.

viii) The Engineer's instructions

The Contractor shall undertake all modifications demanded by the authorities in order to comply with the regulations, and produce all certificates, if any, from the authorities without extra charge.

After completion of the work, the Contractor shall deliver a complete set of "as built" drawings showing the complete installation including all alternations and modifications. The set of drawings shall include but is not limited to all floor plans and diagrams.

10.20 Materials

All materials, fittings and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, and with the relevant British Standard Specification.

Uniformity of type and manufacture of fittings or accessories is to be preserved as far as practicable throughout the whole work.

Wherever in this Specification the practice is adopted of specifying a particular item as 'similar' to that listed in a particular firm's catalogue, it is to be clearly understood that this is to indicate the type and quality of the equipment required. No attempt is being made to give preference to the equipment supplied by the firm whose catalogue is quoted.

Where particular manufactures are specified herein, no alternative makes will be considered without weighty reasons and the Engineer shall have the right to reject any other makes.

The Contractor shall if required by the Engineer submit samples of materials for their approval before placing an order.

The Contractor will be entirely responsible for all materials; apparatus, equipment etc. furnished by him in connection with his work, and shall take all special care to protect all parts of finished work from damage until handed over to the Employer.

The work shall be carried out by competent workmen under skilled and experienced supervision. The Engineer shall have the right to have any part of the work taken down or changed at the Contractor's expense which is executed in an unsatisfactory manner.

Such materials supplied by others for installation and/or connection by the Contractor shall be carefully examined before installation and connection. Any defects noted shall immediately be reported to the Engineer.

10.21 Workmanship

The routes of services and approximate positions of apparatus are shown on the Contract Drawings, but their exact positions shall be determined by approved dimensional details on working drawings or on site by the Engineer in consultation with the Contractor.

The Contractor shall ascertain on site that his work will not foul other services and in all cases the services through the ducts must be readily accessible for maintenance. Any work which has to be re-done due to negligence in this respect will be his responsibility.

The Contractor will be deemed to have allowed in his tender for locating terminal points of services e.g. lighting switches, socket outlets, lighting points) in positions 1 metre horizontally and vertically from the locations shown on Contract Drawings. Within these limits no variation in the Contract sum will be made unless the work has already been executed in accordance with previously approved working drawings or with the Engineer's approval.

The Contractor will be responsible for the provision of all cable ducts and trenches and for their installation, unless otherwise stated in the Specification or Contract Drawings.

The Contractor shall include in his tender for the plugging of all walls, ceilings and floors to facilitate the fixing of the conduits accessories and all other portions of the electrical installations. Any purpose made fixing brackets shall also be provided and installed by the Contractor.

The Contractor shall also be responsible for ensuring that runs for floor or wall chase, holes to be cut or left, will be marked out at the appropriate stage of the structural works.

The Contractor shall be responsible for all cutting away and making good.

The Contractor shall pay particular attention to the fixing and alignment of switch, socket, telephone and similar boxes.

Where conduits are concealed, the boxes shall be in an exact position relative to the finished plaster or such other finish as may be applied to enable cover plates to be accurately positioned

10.22 Main Switchboard

The main switchboard shall be freestanding type switchboard, with front access.

The switchboard shall be constructed, fully wired and checked out at the factory and shall require a minimum of installation work on site. Modular construction shall be used wherever practicable and provision shall be made for simplified servicing, replacement and maintenance throughout without major dismantling.

The enclosures shall be suitable for containing circuit breakers, motor starters and metering equipment from Kenya Power. Where spaces on the switchboard are provided for future circuit components, all ancillary parts shall be installed initially.Full safety precautions shall be provided in all cases.

The switchboard shall be dust and vermin proof and shall have a flexibility of unit arrangement so that extension in the future is possible

Provision for conduit and cable entries shall be made at both top and bottom.

Removable insulated shields shall be provided for protection against contact live parts. All panel components shall be of a sufficient mechanical strength to withstand the influences of short circuits.

All bus-bars and bus-bar connections shall consist of high conductivity copper or aluminium and be provided in accordance with BS 159. The bus-bars shall be clearly marked with the appropriate phase and neutral colours which should be Red. Yellow and blue for the phases and Black for the neutral. The bus-bars shall be so arranged in the switchboard that extension may be made in the future on both sides. Bus-bars shall be rated at the nominated current of the main switch in their entire length.

All wiring within the panel shall be orderly laced and bonded to the panel structure, wiring insulation being coloured according to the colour code. Where single core cables are used special care shall be taken to prevent hysteresis.

A high conductivity cooper earthing bar shall be provided for the full length of the board and all fuse switch units and circuit breakers shall be bonded to this bar.

A wall mounted steel cabinet with a complete set of spare fuses for the main switchboard shall be provided by the Contractor.

All switches, switch fuses, circuit breakers etc. shall be numbered with engraved plastic labels in white letters on black background.

Where wiring passes through holes in metalworks, protection by rubber pushes shall be provided.

10.23 Switchgear

Control voltage of all contactors, automatic switchgear and motor protection gears shall be 220V to 250V**.** The short-circuiting capacity of all circuit breakers, switch gears and motor control gears shall be in accordance with BS 5419.

All fused switch units shall be supplied and installed complete with Class 'Q' H.R.C. cartridge fuse links complying with BS 88, and shall be contained in metal clad, dustproof, gasket sealed individual enclosures with non-detachable steel operating handles which shall be capable of being locked in the 'off' position.

The fused switch units shall have fault ratings at least equal to the fault rating of the switchboard in which they are to be installed.

Moulded case circuit breakers (M.C.C.B) shall comply with BS 4752 and the following requirements:

a) Each M.C.C.B shall be triple pole with pole internally ganged and operated by one central toggle.

b) Each pole shall have a separate thermal and separate magnetic tripping mechanism, both of which shall preferably be adjustable. The toggle assemblies of all three poles shall be internally mechanically interlinked for simultaneous isolation of all three poles under fault conditions, and be so arranged that the overload tripping characteristics calibrations of each pole shall be completely unaffected by the loading of its neighbouring pole or poles.

c) The tripping mechanisms and calibrations shall be unaffected by fluctuating and high ambient temperature. The M.C.C.B.'s shall have a certified short circuit breaking capacity of at least 15,000 Amps (at 480 Volts and 0.3 power factor).

d) Circuit breakers of 100A frame size larger shall have interchangeable over current trip units and adjustable instantaneous trip units.

10.24 Motor Starters

Motor starters for the backwash pumps shall be automatic star delta type fitted with double pole incoming mechanically interlocked circuit breaker housed in a damp and dust proof steel enclosure.

Overload protection shall be provided by a solid state current operated relay as manufacture Omron or equivalent. Backwash pumps shall be stopped automatically by use of float switch installed inside the elevated tank. Two spare relays together with two current connectors shall be provided by the Contractor.

Terminals shall be easily accessible and have adequate clearances between phase and earth. Each starter shall be fitted with start/stop bush buttons with indicator light for running.

10.25 Distribution Boards

The distribution boards shall be as shown on the relevant drawings. The distribution boards are specified as Crabtree metal-clad for flush or cubicle mounting.

Where the requirement for miniature circuit breakers is indicated on the Drawings, the distribution boards shall be fitted with moulded thermo-plastic units of the combined thermal overload and magnetic short circuit tripping type to BS 3871 Part I having clearly marked 'ON' and 'OFF' positions. MCB's of all ratings shall have a minimum short circuit current breaking capacity of 3,000 A for single pole breakers and 4,000 A for triple pole breakers.

10.26 Wiring

All wiring must be carried out in P.V.C single core, copper cables to British Standard.

The wiring throughout shall be carried out by looping cables from point to point and no tees or other joint will be permitted. The entire wiring shall be so organized that later change and renewal can take place without cutting down structural parts. The Contractor must allow in his Tender for all measures of efficient fixing of all wiring items.

The Contractor shall comply with colour code requirements of the regulations.

Low voltage cables and medium voltage cables shall be enclosed in entirely separate conduits.

All cables shall be drawn-in after the installation of the entire conduit system, and after plaster has dried out. Draw wires shall not be threaded in at the time of conduit installation.

Great care shall be taken to ensure that no crossed cables are allowed to enter conduits.

10.27 Cable and Conductors

All cables shall be delivered to the site in their original packing with all seals intact.

Cable dimensions shall comply with the rules and regulations and with the information given on the Drawings or in the Specification.

All cables shall conform to relevant British Standard. No cable dimensions smaller than 1.5sqmm for light and control circuits shall be used.

Where aluminium cables are connected to copper or brass elements in switchboards, etc., an anti-corrosive paste shall be used.

Common saddles shall be used where cables are grouped. All cables shall be terminated with suitable compression type cable glands of the correct size.

All low voltage cables shall be thoroughly soldered or joined with connectors of absolutely reliable type, which hold the conductors in a firm grip, without damaging the wire and without any possibility of vibrating loose.

Underground cables shall be laid in trenches excavated at a minimum depth of 500mm below ground level in the following manner:-

The Contractor shall trim the trench bottom level and if in hard material shall lay 75mm of sand. Cables shall be laid and covered by a further layer of sand to provide 75mm minimum cover. Interlocking concrete or other approved cable covers indelibly marked ‘DANGER HATARI’ shall be provided and laid on the sand covering by the Contractor. Backfilling of the trench shall then be completed.

Cables shall be separated by minimum 50mm of sand filling and kept a minimum of 250mm from other services.

Cables shall cross roads and enter buildings by means of 100mm diameter pitch-fibre or similar non-corrosive pipes. These shall be laid at a minimum depth of 350mm and extend a distance of 600mm on either side of road, etc. The ducts shall be provided and laid by the Contractor. The Contractor shall supply and install concrete marker posts at each entry into building, each change of direction, each road or pathway crossing and throughout the length of the cable at intervals not exceeding 50 metres. Underground ducts must be trained and ducts entering buildings shall be sealed in the end nearest to the building.

The position of all cable markers shall be agreed with the Engineer before installation.

10.28 Conduits

Plastic conduits shall be of best quality new super high impact grade, heavy gauge Class A rigid PVC, unplasticised conduit, suitable for plain connection. Conduits badly formed or bent or damaged in any way must not be used. Conduits not cast or concealed shall be galvanized steel conduits of heavy gauge class B welded and screwed steel and shall comply with British Standards.

In no case shall conduits smaller than 20mm be used:

Conduits to be concealed in structures cast insitu shall be secured to the steel reinforcement work with heavy binding wire, spaced not more than 900mm to prevent movement of the conduit and conduit boxes during the pouring and vibrating of the concrete. Outlet boxes shall be prevent from ingress of concrete, and all boxes shall be fixed to the shuttering with nails or other measures, which must no be visible after removal of the shuttering unless they later can be concealed, e.g. plaster. Conduit shall be installed after the first grid of steel reinforcement work has been securely fixed.

All open ends of conduct shall be protected by coupling plugged with a suitable non-metallic stopping plug. Conduit run in chases in walls or the like shall be fixed by means of mild steel the hooks or saddles spaced at not more than 900 mm where the conduit is concealed behind the plaster, it shall be sunk to a depth of 10mm below finished plaster level before application of the plaster.

Conduit fixed to the surface of walls or ceiling shall be fixed by spaced bar saddles fixed not more than 900mm apart Surface conduit shall also be fixed at 200 mm from boxes, the boxes themselves being securely fixed. Where such an arrangement of boxes and saddles would prove to be both unsightly and unnecessary short lengths of conduit not exceeding 900mn between boxes need not be secured further than by connection to the adjacent boxes. In such cases, the, engineer reserves the right to insist upon having additional fixings provided, should he for any reason whatsoever consider additional fixings necessary special care shall be taken to prevent dirt and plaster to enter any section of the conduit system.

All bends in conduits shall be formed for any decrease or increase of the cross section diameter of the conduits. The radius of the bend shall not be less than as indicated by the British standards. For concealed work, this radius should be increased. No manufactured tees elbows and bends will be permitted. All conduits shall be thoroughly cleaned for sharp edges. The conduits shall be installed avoiding unnecessary bends or changes in direction. Conduits shall be laid in straight lines .Where straight rows of conduit are installed, inspection boxes shall be placed at not more than 15m intervals. There shall be not more than 4 easy bends or 2 right angle bends between boxes. In surface conduit system, inspection bends may be where it seems convenient to replace inspection boxes but only with permission from the engineer

Not more than 6 final sub-circuit cables shall run in conduits feeding outlet boxes. Not more than 8 cables running straight back to the distribution board shall be enclosed in one conduit.

Sub-mains shall not be enclosed in the same conduit as other circuits Lighting sub-circuits shall not be enclosed in the same conduit as single phase sub-circuits shal1 not be enclosed in the same conduit as three phase sub-circuits.

10.29 Boxes

All conduit boxes in connection with plastic conduits shall be of plastic.

Boxes installed externally shall be galvanized and where exposed to direct weather conditions, they shall be compound filled.

All metal boxes shall be fitted with an earth terminal.

Deep boxes or extension rings on standard circular boxes shall be used where necessary in order to bring the front of each box flush with the ceiling or wall.

All screws for holding boxes, lids, etc., in position shall be screwed in. Adaptable boxes shall be screwed by minimum four screws. Conduits shall enter such boxes by means of conduit sockets. Joint boxes without connectors will not be allowed.

All boxes shall match to the equipment installed in the box and genuine parts produced by the same manufacturer shall preferably be used.

All necessary screws, plugs, bolts and other fixings for electrical equipment must be supplied by the Contractor and included in his tender. All fixings in concrete or stone structure shall be by means of rawl plugs or similar plugs in elastic.

All spare ways in junction boxes and the like left for possible future extension shall be fitted with stopping plugs.

10.30 Light fittings

All light fittings shall be supplied by the Contractor. The Contractor shall include in his tender for clearing, installation, connection and supply of light sources in accordance schedule of light fittings and drawings or as directed by the Engineer.

Fluorescent fittings shall except where otherwise specified be phase compensated by means of a phase capacitor, LC coupling or M coupling

Where earthing of light fittings is necessary, it is to be effected without using, chains or other rigid supports as conductors. All light fittings shall be cleaned and installed in complete working order before handing over.

10.31 Security Light Fittings

All external security light fittings shall be controlled by a photocell contactor located as shown in the relevant drawings. The photocell unit shall be fixed at 2000 mm above ground level on either north or south of external wall of indicated building.

10.32 Light switches

Light switches shall be 5 or 20 Amp according to the load switched.

They shall be as manufacture Crabtree with ivory colour moulded covers. They shall be suitable for switching inductive loads and mounted in pressed steel boxes on adjustable grids. They shall be installed at a height of 1400mm above finished floor level.

10.33 Meter Boxes

The Contractor shall supply and install a standard single or Dual Tariff Meter box where called for on the Contract Drawings. He shall also provide the necessary conduits for the Kenya Power Ltd, service cable entry.

10.34 Power Installation

The installation for power shall be concealed in walls and floors in PVC conduits. Precise positions of these and control switches shall be ascertained by the contractor.

The Contractor shall supply, fix and connect isolators to equipment as shown below.

The tender price shall be based on the following heights for isolators and socket outlets, unless specifically stated otherwise on the drawings.

Isolators 1400mm above -finished -floor level.

Socket outlets -flush at 250mn above finished floor level.

All socket outlets jointed above worktops shall be flush mounted at 150mm above worktop.

The motor installation shall include isolating switch and terminating box fixed at the wall 1400mm. Flexible cable shall be provided between the box and the terminal box at the motor. The flexible cable shall be installed with sufficient coils to enable "tong-test readings" for each phase.

All adaptors shall be solid bronze or brass pattern with standard thread.

10.35 Earthing and bonding

Earthing and bonding shall be carried out to the requirements of the current 14th edition of the IEE regulations and GES 1and 2. In particular, attention is drawn to IEE regulation D5, D6, D7 and D29.

An earth electrical system shall be installed at point adjacent to the main supply intake and at every building served by external distribution System.

Each earth electrode shall be a 12mm diameter copper rod driven to1300 mm. in rocky soil conditions, where this depth is difficult to obtain the Contractor shall obtain written approval from the engineer for an alternative earth electrode system.

The electrode shall be connected via a green PVC insulated copper to an earth terminal adjacent to the incoming supply, to which all cable armouring, conduit, trucking, switchgear etc. shall be bonded, together with all other metallic incoming services, e.g.- water etc. Provision shall also be made for connection with the neutral of the incoming supply.

Where P.M.E. is approved and after the Supply Authority has made its connection, the Contractor shall similarly connect the neutral of each distributor main to earth at its remote end.

The bonding of other services or connections of neutral to earth shall be made after satisfactory completion of earth continuity and line earth loop impedance test. Tests of the resistance to earth of each electrode system shall also be carried out and the results recorded.

The maximum reading shall not exceed that laid down by Kenya Power Ltd and in any case shall not exceed 2 ohms.

Means shall be provided, e.g. a test clamp, to isolate the electrode from the system for periodic testing-

Internal earthing and bonding shall comply with the current edition of the IEE Regulations except that insulated switches and Lighting fittings need not be earthed

from a safety aspect .Certain fittings however, may require to be earthed to effect proper operation.

All cable glands for SWA underground type cable, where installed, shall be fitted with an approved earthing washer having a tag for the Connection of an earth lead. Every such washer installed shall- be connected by an insulated earthing lead to a proper earthing terminal by means of a lug or washers on the adjacent: switcher or other equipment**.**

10.36 Testing

All tests Prescribed in the 14th edition of the regulations for the electrical Equipment of the institution of electrical Engineers, together with all amendments as applicable, shall be carried out by the Contractor on the completed installation. In addition, testing of all special equipment to the complete satisfaction of the engineer and such other persons or authorities concerned with the installation shall be carried out by the contractor.

Tests may also be required during progress of the Contract for insulation resistance, continuity of a conduit and earth connections and also the ability to withdraw all cables or any, cables from the conduits.

In addition to any tests required by the Supply Company upon completion of the installation, tests for polarity, insulation resistance, earth continuity and adequate operation of all parts of the installation shall as stated above, be carried out by the contractor

The contractor shall provide accurate instruments and apparatus and all labour required for such testing.

All tests must be carried out in the presence of the Engineer or such other person appointed for this purpose, but the Contractor alone will be held responsible to the authorities as to the installations compliance with rules and regulations.

The Contractor will be required to give all notices or details to enable the installation to be tested or inspected. All fees arising from the inspection and in subsequent inspection or re-testing shall be paid by the Contractor.

Duplicate copies of the results of these tests shall be provided within 14 days of the witnessed tests, and the Contractor will be required -to issue to the Engineer the requisite Certificate upon completion, as required under the regulations referred to above.

Any faults, defects, omissions or faulty workmanship, incorrectly positioned or installed parts of the installation made apparent by such inspection or tests shall be rectified by the Contractor at his own expense.

10.37 Handing Over

The Contract works shall be considered complete and the maintenance and defects notification period shall commence only when the Contract Works and supporting services have been tested, commissioned and operated to the satisfaction of the Engineer and officially approved and accepted by the Employer.

The procedure to be followed will be as follows:-

(a) On completion of the Contract works to the satisfaction of the Engineer, the Contractor shall request the Engineer to arrange for handing over.

(b) The Engineer shall then arrange a handing-over meeting or a series thereof at the site.

(c) The Contractor shall arrange with the Engineer and the employer a complete demonstration to be carried out of each and every service and for instructions to be given to the relevant operating staff and other representatives of the Employer.

(d) The Contractor shall arrange approved Handing Over Certificate and check Lists of all controls and items of equipment, tools, spares and the like.

10.38 Maintenance and Defects Notification Period

The contractor shall maintain the complete electrical installation and associated equipment for a period of minimum 24 months from the date that the installation is handed over to the client. The Contractor shall be held responsible for and shall make good all defects in materials and workmanship that occur during the twenty four (24) months maintenance period. The period of liability shall not end until all defects which appear during the maintenance period have been rectified. Any item of material found to be defective shall be replaced by the contractor within seven days of his being notified and any results of defective workmanship shall be repaired including supply of new parts necessary immediately upon being notified.

The Contractor shall allow in his tender price for this maintenance and service and shall provide for all tools, instruments, plant and scaffolding, and the transportation thereof, as required for the full correction and full execution of these obligations, and the provision, use or installation of all materials whether they are normal maintenance materials such as oils, greases, sand paper etc. and parts which are periodically renewed such as relay contacts or parts which are faulty for any reason whatsoever excepting always Acts of God such as storm, tempest or flood, lighting and earthquakes; and civil revolt, acts of war and vandalism.

ELECTRO-MECHANICAL EQUIPMENT

10.39 Scope of Supply

The scope of supply comprises the complete mechanical equipment, consisting of the following main parts:

- Piping with Accessories
- Pumps for filter backwashing
- Pumps for recirculation
- Air Blower for Filter Backwashing
- Internal Water Supply
- Aluminium Sulphate Dosing
- Soda Ash Dosing
- Calcium Hypochlorite Dosing
- Control Measuring and Safety Devices

It is required to supply, erect, and supervises the erection and delivery in good working order the mechanical and electrical equipment and facilities of the water treatment plant as well as to provide its maintenance during the guarantee period.

The works consist of furnishing all equipment to be complete and ready for operation when installation is completed, even if they are not mentioned in the Specifications. All accessories shall be furnished and included in the Tender Price of the Bill of Quantities/Price List. The Contractor shall furnish all foundation materials required to support and hold the diverse equipment as pumps, piping, armatures, etc.

Spare parts in order to obtain a complete, reliable' and operational plant as more fully described hereinafter to get potable water in accordance with the World Health Organization (WHO) Standards.

10.39.1 Piping with Accessories

The scope of works includes all pipes, fittings, valves, connecting and fixing materials with installation. The connecting material (screws, nuts and gaskets) as well as the fixing material (supports, clamps and suspenders) for the equipment which is to be installed in or on the pipes (e.g. valves, dismantling pieces, measurement and control devices) are to be included. Furthermore, the pressure test, the flushing and the disinfection of the pipes is to be quoted with the relevant items of the B.O.Q.(Bill of Quantities).

Further all parts to be embedded in concrete shall be placed according to the drawings or as instructed by the Engineer at site with written approval.

10.39.2 Design Requirements:

The maximum internal pressure of the collecting well piping is the test pressure. The design pressure shall be PN 10. all parts shall be made of steel.

10.39.3 Valves and Accessories

The Contractor shall furnish all valves and other accessories for pipe installation as specified herein and as shown on the drawing and in the Bill of Quantities. All valves and other accessories shall be of the size specified and, as far as possible; all valves of the same type shall be of one manufacturer.

All valves and accessories shall have cast on the body the name of the manufacturer, working pressure, diameter, and direction of flow.

All flanges for pipes, fittings, valves shall comply with DIN 28604 for PN 16.

Stuffing boxes shall be of the "O" ring or packing type, unless otherwise specified.

The Supplier shall submit shop drawings to the Engineer for approval. Shop drawings shall include:

- lists and schedules of materials
- details of joints (and adaptors if necessary)
- Names of manufacturers, size, details, materials, and thickness of all items.

All valves and accessories shall be designed for a working pressure of not less than PN 16, unless otherwise specified. The Supplier shall submit a certificate from the manufacturer certifying that each valve meets the requirements of the specifications.

Valves shall be equipped with hand lever, hand wheel, or as specified. Valve ends shall be flanged, Screws and rubber ring gaskets shall be provided to joint to the valve with the piping.

10.39.4 Gate Valves

Gate valves are to be provided according to DIN 3352 for water up to 40 degrees Celsius with fixed, non-rising hand-wheel. The body shall be of cast iron GG-25 or ductile iron.

10.39.5 Butterfly Valves

Each valve shall consist, essentially, of a cast-iron or ductile iron body with a rubber seat, a disc, a valve shaft, and an operating mechanism.

It shall conform in all respects to DIN 3354, part 2.

10.39.6 Air Release Valves

Air release valves shall have high strength cast or ductile iron bodies. The valves shall contain an integral shut-off valve for use during maintenance.

All moving parts shall be of stainless steel.

Complete unit with gate valve connection of the single and double type shall be provided as shown on the drawings and wherever necessary.

10.39.7 Safety Valve

The safety valve shall be a spring-loaded type with adjustable pressure range as shown in the Bill of Quantity. The safety valve shall be manual releasable by a lever arm.

10.39.8 Non-Return Valves

Non-return device with silent action tight sealing designed for a pressure of PN 16 for streamlined flow and minimum head loss.

10.39.9 Float Outlet Valve

Float-operated level control valve, angle-type body for water reservoirs. Closing with rising water level and opening with sinking water level. Balanced valve piston shall ensure minimum operating forces. A long piston guiding shall prevent canting. Closing action shall be shock-free.

10.39.10 Dismantling Piece

The dismantling piece shall be rigid type and provided with steel middle ring, steel followers, gas and necessary bolts and nuts of galvanized steel. They have to be installed in their medium length.

10.39.11 Pipe Compensator

The pipe compensator shall be of rubber type and provided with flange as specified in the Bill of Quantity. The pipe compensator shall contain anchor sturdy of strength adequate to hold the pipe together under a pull equal to the longitudinal strength of the pipe.

10.39.12 Wall Duct

The wall duct shall be of steel body and provided with rubber/solid gasket, bolt and nuts, and loosed flange according to working pressure as specified in

the Bill of Quantity. The length of wall duct shall be suitable of the concrete wall width specified in the Bill of Quantities.

The connecting pipe to be inserted in the wall duct shall have four degrees deflection without any leaks.

10.40 Filter Plant

10.40.1 Scope of Works

The following main components are to be provided and assembled:-

- Pump Sets (two duty, one standby)
- Air Blower Sets (One standby)
- Piping with Accessories
- Measuring Devices

10.40.2 Backwash Pump Set

The pumps shall be horizontal centrifugal volute casing pump type coupled with appropriately rated electrical motor and will be installed in a pump house.

The total efficiency of pump and motor shall be as high as possible. Operation of the pumps shall be 2 duty pump and 1 stand-by. The pumps shall be capable of raising water from the outlet of the clear water tanks to the elevated backwash water tank.

10.40.3 Scope of Works

The following components are to be provided and assembled to one unit:-

Each pump; Single stage horizontal volute casing centrifugal pump rated 48m^3/hr against a head of 45m coupled with using HRC couplings to an 11kW, 3ph, 1450rpm squirrel cage motor, all mounted on a common prefabricated steel baseplate.

Motor characteristics:

Overheating protection:	by over current and phase failure strip
Cooling:	surface
Insulation class:	F (motor dimensioning for B)
Protection class:	minimum, IP 55
Power supply:	415 V, AC, 50 Hz, 3-phase
Starting:	Star/delta
Phasing	3
Rev per minute	1450

Particular Requirements

Pump and motor shall be mounted on a common rigid base frame. The shafts shall be coupled by HRC coupling, which must be easily replaceable.

10.40.4 Air Blower Set

The scope of supply shall comprise: 2 scour air blowers with motors, air inlet filters and silencers; piping, no return valves, butterfly type shut-off valves, safety unloaded and drain valves.

Type

Rotary piston air blower set, directly coupled via an elastic coupling with electric motor, both mounted on a common rigid base frame.

Motor characteristics:

The blower shall be completely equipped with an automatic unloading device for starting, with dead weight pressure relief valve, pressure gauge, etc.

The air inlet pipes shall be fed through the machine hall wall and the inlet filters shall be mounted on the exterior side of the wall.

The blower shall be equipped with noise absorbing housings. Both, delivery pipes between the rubber compensators of the blower and the main header to the filter, including the manually operated butterfly valves and an automatic drain valve for draining of condensed water shall be furnished. The piping shall be of the steel-flanged type.

Piping and Accessories

The scope of works includes all pipes, fittings, valves, connecting and fixing materials with installation at the filter plant including connection piping to the pump house and the piping in the pump house itself.

The connecting material (screws, nuts and gaskets) as well as the fixing material (supports, clamps, and suspenders) for the equipment which is to be installed in or on the pipes (e.g. valves, dismantling pieces, measurement and control devices) are to be included. Furthermore, the pressure test, the flushing and the disinfection of the pipes is to be quoted with the relevant items of the B.O.Q. (Bill of Quantities).

Further all parts to be embedded in concrete shall be located according to the drawings or according to the instructions by the Engineer at site with written approval.

Design Requirements

The maximum internal pressure of the filter plant piping is the test pressure. The design pressure shall be PN 16. All parts shall be made of cemment linned epoxy coated steel.

10.40.5 Measuring Devices

Flow meters shall be provided for each discharge pipe of the backwash pumps to the Engineer’s satisfaction and approval. Hour meters of each pump and air blower shall be provided.

10.41 Chemical Treatment Plant

The chemical treatment consists of three plants to store, prepare and feed the chemicals:

- Aluminium sulphate for coagulation
- Soda ash (sodium carbonate) for pH correction
- Calcium hypochlorite for disinfection.

The equipment for the chemical treatment will be arranged in four rooms as follows:

10.41.1 Scope of Supply

The following components are to be provided and to be assembled:

- Internal water supply
- Air Supply
- Aluminium Sulphate Dosing
- Soda Ash Dosing
- Calcium Hypochloride Dosing _
- Control Measuring and Safety Devices
- Piping with Accessories

10.41.2 Weighing Devices

The chemical house shall be provided with one weighing device with a capacity of 100 kg with division to enable accurate control of coagulant solutions concentration.

Pipes and Fittings

The chemical house shall be provided with all necessary connecting pipes between tanks, pumps, and injection point. The pipes shall be fitted with all necessary fittings, erection pieces, valves etc. All piping shall be of the poly-vinyl chloride pipes. All valves shall be made of either poly-vinyl chloride or rubber-lined grey cast iron.

The feeding pipes shall be installed as DN 16; the maximum flow velocity shall be 0.21 n/sec.

10.41.3 Soda Ash Dosing

A complete soda ash feed system shall be provided with efficient modern devices for measuring and adding the required chemicals to the water treatment.

All feeding chemical equipment shall be capable of manual adjustment according to the variations in the raw water quality and/or flow indicated by the flow meter fitted to the raw water pipe.

The soda ash is delivered as powder or granulates in 50 kg bags. Its active ingredient of Na_2C0_3 is 99 to 100%.

The solution will be prepared batchwise in two tanks of a net volume of 560.1

The average dosing rate will be 8 g/ m^3 and the maximum dosing rate will be 16 g/ m^3 (related to the delivered chemicals).

This results 4.8% maximum strength of the solution. That means 26.81 kg soda ash are to be mixed with water to 560 1 solution.

Based on the average feeding rate of 8 g/ m^3, the volume of 560 1 solution has to contain 13.40 kg soda ash.

An alarm "Trunk Empty" will be triggered by an electrical signaller if the level of the solution drops to a minimum.

The scope of supply includes in general:

- soda dissolving tanks,
- 3 soda metering pumps (one as stand-by)
- pipes and fittings as necessary.

Soda Dissolving Tanks

The Contractor shall furnish four soda dissolving tanks. Each shall have a capacity of net 2000 lts.

Soda Metering Pumps

Three metering pumps (one as stand-by unit) are to be installed, each capable of handling a capacity of Q = 2000 l/h.

To facilitate the maintenance and to minimize the needed spare parts, the same type of metering pump will be installed as described before.

10.41.4 Piping with Accessories

Scope of Works

The scope of works includes all pipes, fittings, valves, connecting and fitting materials with installation in the pump station including connecting piping to the distribution system.

The connecting material (screws, nuts, and gaskets) as well as the fixing material (supports, clamps, and suspenders) for the equipment, which is to be installed in or on the pipes (e.g. valves, dismantling pieces, measurement, and control devices) are to be included. Furthermore* the pressure test, the flushing and the disinfection of the pipes has to be quoted with the relevant items of the B.O.Q (Bill of Quantities).

Further all parts to be embedded in concrete shall be placed according to the drawings or as instructed by the Engineer at site with written approval.

Design Requirements

The maximum internal pressure of the plant piping l the test pressure. The design pressure shall be PN 16. All parts shall be made of steel.

10.41.5 Measuring Devices

Water Level Measurement and the pump controls.

Sets of electodes shall be installed inside the pump sump(clear water tank) for indication of water levels (LOW AND HIGH) and the same electrodes to serve as dry run protectors. The indicator lamps shall be provided on the control panels.

10.41.6 Calcium hypo-chlorite Dosing

A complete calcium hypo-chlorite feed system shall be provided with efficient modern devices for measuring and adding the required chemicals to the water treatment.

All feeding chemical equipment shall be capable of manual adjustment according to the variations in the raw water quality mid/or flow indicated by the flow meter fitted to the raw water pipe.

The calcium hypo-chloride is delivered as powder or granulates in 50 kg drums. Its active ingredient as free chlorine is approximately 60% by weight. The maximum feeding rate at the inflow of the clear water reservoir shall be 3 g/m^3 (600 g/hr) chlorine (equivalent to 5 g/m^3 calcium hypo-chloride) for post chlorination.

For the maximum demand during operation of chlorination with a summarized feeding rate of 3 g/m^3 (calcium hypo-chloride) and a plant capacity of Q = 200 m^3/hr. the solution is to be prepared in one solution tank, whose net volume is 186 l, using 13.90 kg calcium hypo-chloride: the strength of the solution is 7.47%, When a lower demand is to be expected, e.g. 1,5 $\%/m^3$ the strength can be reduced to 2.51 kg for 186 l solution (0.45% strength).

To prepare the solution, the selected quantity of calcium hypo-chloride will be filled in the tank. Later, the solution will be completed by filling water to 186 1 total volume. Finally, it will be mixed manually by a mechanically operated stirrer.

Due to the insoluble particles of the calcium by hypo-chloride, a swimming skimmer, which is flexibly connected to the solution outlet should, be used to abstract this from the surface. An additional outlet is to be used periodically to desludge the bottom of the tank.

The solution is fed by gravity via hand operated Valve to one of two dilution tanks located below the solution tank. Each dilution tank has a net volume of 560 1. The solution of the upper tank is to be diluted in the ratio 1:2 by completing 280 1 water and mixing by a mechanically operated stirrer to the approval of the Engineer.

The scope of supply includes in general:

i) Calcium hypo chloride solution tank net capacity 186 l, with hand operated stirrer.

ii) Calcium hypo chloride dilution tanks net capacity 560 l. With hand operated stirrer.

iii) Calcium hypo chloride metering pumps (one as stand-by).

Pipes and Fittings

These will be similar to the ones for soda ash dosing.

10.42 Measurements and payments

a) Electromechanical equipment

Unit: nr

Measurement of electromechanical works shall be measured in number of each equipment delivered on site. 60% of the payment shall be paid on delivery of the complete set of equipment to site and submission of the test certificate from the manufacturer to the Employer, 40% on installing, testing and commissioning.

The rate shall include for the rate of complying with the requirements of Section 11 of this specification and fittings, accessories, piping,connection, earthing, installation and testing to the satisfaction of the Engineer.

b) Security lighting

		Unit
i)	Lanterns	Nr
ii)	Street lighting columns	Nr
iii)	MCBS	Nr
iv)	Cables	m
v)	Hatari warning tiles	Nr
vi)	Cable route markers	Nr
vii)	PVC service ducts	Nr
viii)	Photocell light controls	m

Measurement of security/street lighting items listed above shall be measured in numbers supplied or linear metres as appropriate. The rate shall include costs for supply material, fittings and accessories for each unit, fabricating, installing and preparation of shop drawings to the approval of the Engineer.

11. – DAYWORKS

11.1 Measurement and Payment

Where items of major equipment listed in the schedule of Dayworks are specified by type (e.g. concrete mixer e.t.c.) the power rating of such items of equipment to be provided by the Contractor shall not be lower than the power ratings of such equipment, manufactured within the last two years prior to the date of Tender. Any item of major plant employed upon Dayworks which has a power rating lower than specified shall be paid for at rates lower than those in the schedule of Dayworks. The reduction in the rate payable shall be in proportion to the reduction in power rating below that specified above.