NATIONAL IRRIGATION AUTHORITY

TENDER DOCUMENT

TENDER NAME: MAINTENANCE SERVICE CONTRACT FOR IRRIGATION PUMPS, GENERATORS AND ASSOCIATED INSTALLATIONS IN COUNTRY WIDE NATIONAL PUBLIC IRRIGATION SCHEMES

TENDER NO.: NIA/T/193/2019-2020

PUBLISHED ON: 16TH JUNE 2020

TENDER DOCUMENT ISSUED ON: 19TH JUNE 2020

SUBMISSION DEADLINE: 15TH JULY 2020 AT 12.00 NOON LOCAL TIME

PROCURING ENTITY:
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SECTION I. INVITATION TO TENDER

NATIONAL OPEN TENDER

The National Irrigation Authority invites sealed tenders for the following:

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<th>S.No.</th>
<th>Tender No.</th>
<th>Tender Name</th>
<th>Document Upload Date</th>
<th>Tender Submission Deadline</th>
<th>Target group</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>NIA/T/192/2019-2020</td>
<td>Provision of Insurance Brokerage Services to National Irrigation Authority for the FY 2020-2021</td>
<td>19th June 2020</td>
<td>14th July 2020 at 12.00 noon local time</td>
<td>General public</td>
</tr>
</tbody>
</table>

Detailed tender documents that include mandatory preliminary requirements, technical and financial evaluation criteria may be viewed and obtained by interested and eligible tenderers free of charge from the Board’s website: http://www.nib.or.ke/tenders or GoK’s e-procurement portal, http://www.supplier.treasury.go.ke from 19th June 2020. Tenderers who intend to submit their tenders MUST promptly submit their names and contact details to: purchasing@nib.or.ke or enquiries@nib.or.ke for communication of any clarification(s) and addendum(s) during the tendering process.

ADDENDUM NO.02

<table>
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<tr>
<th>S. No.</th>
<th>Tender No.</th>
<th>Addendum</th>
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1. NIB/T/191/2019-2020 | **Addendum No.02** | Tender for Construction Works of Nyandarua Clusters Irrigation Project, Nyandarua County | 30th June 2020 | 22nd July 2020 at 12.00 noon local time


In accordance with Clause 7 of Instructions to Tenderers (ITT) of the issued tender document, the Employer, National Irrigation Authority (Authority) is amending the tender upload date from 12th June 2020 to 30th June 2020 and the tender submission deadline from 30th June 2020 to 22nd July 2020. The other details, terms and conditions remain the same.

**Physical Address**
Chief Executive Officer/CEO
National Irrigation Authority (NIA)
Unyunyizi House, First Floor, Room 309
Lenana Road, Hurlingham, Nairobi, Kenya
Tel: +254-20-2711380/468
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E-mail: purchasing@nib.or.ke

**CHIEF EXECUTIVE OFFICER/CEO**
**NATIONAL IRRIGATION AUTHORITY.**
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SECTION II - INSTRUCTIONS TO TENDERERS

2.1. Eligible Tenderers

2.1.1 This Invitation for Tenders is open to all tenderers eligible as described in the Appendix to Instructions to Tenderers. Successful tenderers shall provide the services for the stipulated duration from the date of commencement (hereinafter referred to as the term) specified in the tender documents.

2.1.2 The procuring entity’s employees, committee members, board members and their relatives (spouse and children) are not eligible to participate in the tender unless where specially allowed under section 131 of the Act.

2.1.3 Tenderers shall provide the qualification information statement that the tenderer (including all members of a joint venture and sub service providers) is not associated, or have been associated in the past, directly or indirectly, with a firm or any of its affiliates which have been engaged by the Procuring entity to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the services under this Invitation for tenders.

2.1.4 Tenderers involved in the corrupt or fraudulent practices or debarred from participating in public procurement shall not be eligible.

2.2 Cost of Tendering

2.2.1 The Tenderer shall bear all costs associated with the preparation and submission of its tender, and the procuring entity, will in no case be responsible or liable for those costs. Regardless of the conduct or outcome of the tendering process.

2.2.2 The price to be charged for the tender document shall not exceed Kshs.5,000/=.

2.2.3 The procuring entity shall allow the tenderer to review the tender document free of charge before purchase.

2.3 Contents of Tender Document

2.3.1 The tender documents comprise the documents listed below and addenda issued in accordance with clause 2.5 of these instructions to tenderers.

(i) Instructions to Tenderers
(ii) General Conditions of Contract
(iii) Special Conditions of Contract
(iv) Schedule of Requirements
(v) Form of Tender
(vi) Price Schedules
(vii) Contract Form
(viii) Confidential Business Questionnaire Form
(ix) Tender security Form

(x) Performance security Form  
(xi) Manufacture’s Authorization Form  
(xii) Anti-Corruption Declaration Form  

2.3.2 The Tenderer is expected to examine all instructions, forms, terms and specification in the tender documents. Failure to furnish all information required by the tender documents or to submit a tender not substantially responsive to the tender documents in every respect will be at the tenderer’s risk and may result in the rejection of its tender.

2.4 Clarification of Tender Documents  

2.4.1 A Candidate making inquiries of the tender documents may notify the Procuring entity by post, fax or by email at the procuring entity’s address indicated in the Invitation for tenders. The Procuring entity will respond in writing to any request for clarification of the tender documents, which it receives not later than seven (7) days prior to the deadline for the submission of the tenders, prescribed by the procuring entity. Written copies of the Procuring entities response (including an explanation of the query but without identifying the source of inquiry) will be sent to all candidates who have received the tender documents.

2.4.2 The procuring entity shall reply to any clarifications sought by the tenderer within 3 days of receiving the request to enable the tenderer to make timely submission of its tender.

2.4.3 Preference where allowed in the evaluation of tenders shall not exceed 15%  

2.5 Amendment of Tender Documents  

2.5.1 At any time prior to the deadline for submission of tenders, the Procuring entity, for any reason, whether at its own initiative or in response to a clarification requested by a prospective tenderer, may modify the tender documents by issuing and addendum.

2.5.2 All prospective tenderers who have obtained the tender documents will be notified of the amendment by post, fax or email and such amendment will be binding on them.

2.5.3 In order to allow prospective tenderers reasonable time in which to take the amendment into account in preparing their tenders, the Procuring entity, at its discretion, may extend the deadline for the submission of tenders.

2.6 Language of Tenders  

2.6.1 The tender prepared by the tenderer, as well as all correspondence and documents relating to the tender exchanged by the tenderer and the Procuring entity, shall be written in English language. Any printed literature furnished by the tenderer may be written in another language provided they are accompanied by an accurate English translation of the relevant passages in which case, for purposes of interpretation of the tender, the English translation shall govern.

**Tender Document:** Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes,  
NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
2.7. **Documents Comprising the Tender**

2.7.1 The tender prepared by the tenderer shall comprise the following components:

- **(a)** A Tender Form and a Price Schedule completed in accordance with paragraph 2.8, 2.9 and 2.10 below
- **(b)** Documentary evidence established in accordance with paragraph 2.11.2 that the tenderer is eligible to tender and is qualified to perform the contract if its tender is accepted;
- **(c)** Tender security furnished in accordance with paragraph 2.12 (if applicable)
- **(d)** Declaration Form.

2.8. **Form of Tender**

2.8.1 The tenderer shall complete the Tender Form and the Price Schedule furnished in the tender documents, indicating the services to be provided.

2.9. **Tender Prices**

2.9.1 The tenderer shall indicate on the form of tender and the appropriate Price Schedule the unit prices and total tender price of the services it proposes to provide under the contract.

2.9.2 Prices indicated on the Price Schedule shall be the cost of the services quoted including all customs duties and VAT and other taxes payable.

2.9.3 Prices quoted by the tenderer shall remain fixed during the Term of the contract unless otherwise agreed by the parties. A tender submitted with an adjustable price quotation will be treated as non-responsive and will be rejected, pursuant to paragraph 2.20.5

2.10. **Tender Currencies**

2.10.1 Prices shall be quoted in Kenya Shillings

2.11. **Tenderers Eligibility and Qualifications**

2.11.1 Pursuant to paragraph 2.1 the tenderer shall furnish, as part of its tender, documents establishing the tenderer's eligibility to tender and its qualifications to perform the contract if it's tender is accepted.

2.11.2 The documentary evidence of the tenderer’s qualifications to perform the contract if its tender is accepted shall establish to the Procuring entity’s satisfaction that the tenderer has the financial and technical capability necessary to perform the contract.

2.12. **Tender Security**

2.12.1 The tenderer shall furnish, as part of its tender, a tender security for the amount and form specified in the Appendix to Instructions to Tenderers.
2.12.2 The tender security shall not exceed 2 per cent of the tender price.

2.12.3 The tender security is required to protect the Procuring entity against the risk of Tenderer’s conduct which would warrant the security’s forfeiture, pursuant to paragraph 2.12.7.

2.12.4 The tender security shall be denominated in Kenya Shillings or in another freely convertible currency, and shall be in the form:
   a) Cash.
   b) A bank guarantee.
   c) Such insurance guarantee approved by the Authority.
   d) Letter of credit.

2.12.5 Any tender not secured in accordance with paragraph 2.12.1 and 2.12.3 shall be rejected by the Procuring entity as non-responsive, pursuant to paragraph 2.20.5.

2.12.6 Unsuccessful Tenderer’s tender security will be discharged or returned as promptly as possible but not later than thirty (30) days after the expiration of the period of tender validity.

2.12.7 The successful Tenderer’s tender security will be discharged upon the tenderer signing the contract, pursuant to paragraph 2.29, and furnishing the performance security, pursuant to paragraph 2.30.

2.12.8 The tender security may be forfeited:

(a) if a tenderer withdraws its tender during the period of tender validity.
(b) in the case of a successful tenderer, if the tenderer fails:
   (i) to sign the contract in accordance with paragraph 2.29 or
   (ii) to furnish performance security in accordance with paragraph 2.29.

(c) If the tenderer reject correction of an arithmetic error in the tender.

2.13 Validity of Tenders

2.13.1 Tenders shall remain valid for 60 days after date of tender opening pursuant to paragraph 2.18. A tender valid for a shorter period shall be rejected by the Procuring entity as non-responsive.

2.13.2 In exceptional circumstances, the Procuring entity may solicit the Tenderer’s consent to an extension of the period of validity. The request and the responses thereto shall be made in writing. The tender security provided under paragraph 2.12 shall also be suitably extended. A tenderer granting the request will not be required nor permitted to modify its tender.

2.14 Format and Signing of Tenders
2.14.1 The tenderer shall prepare an original and a copy of the tender, clearly marking each “ORIGINAL TENDER” and “COPY OF TENDER,” as specified in the Appendix. In the event of any discrepancy between them, the original shall govern.

2.14.2 The original and all copies of the tender shall be typed or written in indelible ink and shall be signed by the tenderer or a person or persons duly authorized to bind the tenderer to the contract. All pages of the tender, except for un-amended printed literature, shall be initialed by the person or persons signing the tender.

2.14.3 The tender shall have no interlineations, erasures, or overwriting except as necessary to correct errors made by the tenderer, in which case such corrections shall be initialed by the person or persons signing the tender.

2.15 Sealing and Marking of Tenders

2.15.1 The tenderer shall seal the original and the copy of the tender in separate envelopes, duly marking the envelopes as “ORIGINAL TENDER” and “COPY OF TENDER”. The envelopes shall then be sealed in an outer envelope.

2.15.2 The inner and outer envelopes shall:

(a) be addressed to the Procuring entity at the address given in the Invitation to Tender bear tender number and name in the invitation to tender and the words, “DO NOT OPEN BEFORE 15TH JULY 2020 AT 12.00 NOON LOCAL TIME.

2.15.3 The inner envelopes shall also indicate the name and address of the tenderer to enable the tender to be returned unopened in case it is declared “late”.

2.15.4 If the outer envelope is not sealed and marked as required by paragraph 2.15.2, the Procuring entity will assume no responsibility for the tender’s misplacement or premature opening.

2.16 Deadline for Submission of Tenders

2.16.1 Tenders must be received by the Procuring entity at the address specified under paragraph 2.15.2 not later 15TH JULY 2020 AT 12.00 NOON LOCAL TIME.

2.16.2 The Procuring entity may, at its discretion, extend this deadline for the submission of tenders by amending the tender documents in accordance with paragraph 2.5.3 in which case all rights and obligations of the Procuring entity and candidates previously subject to the deadline will thereafter be subject to the deadline as extended.

2.16.3 Bulky tenders which will not fit the tender box shall be received by the procuring entity as provided for in the appendix.
2.17 Modification and Withdrawal of Tenders

2.17.1 The tenderer may modify or withdraw its tender after the tender’s submission, provided that written notice of the modification, including substitution or withdrawal of the tenders, is received by the Procuring entity prior to the deadline prescribed for submission of tenders.

2.17.2 The tenderer’s modification or withdrawal notice shall be prepared, sealed, marked and dispatched in accordance with the provisions of paragraph 2.15. A withdrawal notice may also be sent by fax or email but followed by a signed confirmation copy, postmarked not later than the deadline for submission of tenders.

2.17.3 No tender may be modified after the deadline for submission of tenders.

2.17.4 No tender may be withdrawn in the interval between the deadline for submission of tenders and the expiration of the period of tender validity. Withdrawal of a tender during this interval may result in the Tenderer’s forfeiture of its tender security, pursuant to paragraph 2.12.7.

2.18 Opening of Tenders

2.18.1 The Procuring entity will open all tenders in the presence of tenderers’ representatives who choose to attend, ON 15TH JULY 2020 AT 12.00 NOON LOCAL TIME and in the location specified in the invitation for tenders. The tenderers’ representatives who are present shall sign a register evidencing their attendance.

2.18.2 The tenderers’ names, tender modifications or withdrawals, tender prices, discounts, and the presence or absence of requisite tender security and such other details as the Procuring entity, at its discretion, may consider appropriate, will be announced at the opening.

2.18.3 The Procuring entity will prepare minutes of the tender opening, which will be submitted to tenderers that signed the tender opening register and will have made the request.

2.19 Clarification of Tenders

2.19.1 To assist in the examination, evaluation and comparison of tenders the Procuring entity may, at its discretion, ask the tenderer for a clarification of its tender. The request for clarification and the response shall be in writing, and no change in the prices or substance of the tender shall be sought, offered, or permitted.

2.19.2 Any effort by the tenderer to influence the Procuring entity in the Procuring entity’s tender evaluation, tender comparison or contract award decisions may result in the rejection of the tenderers’ tender.
2.20 Preliminary Examination and Responsiveness

2.20.1 The Procuring entity will examine the tenders to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the tenders are generally in order.

2.20.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected. If the candidate does not accept the correction of the errors, its tender will be rejected, and its tender security forfeited. If there is a discrepancy between words and figures, the amount in words will prevail.

2.20.3 The Procuring entity may waive any minor informality or non-conformity or irregularity in a tender which does not constitute a material deviation provided such waiver does not prejudice or affect the relative ranking of any tenderer.

2.20.4 Prior to the detailed evaluation, pursuant to paragraph 2.20, the Procuring entity will determine the substantial responsiveness of each tender to the tender documents. For purposes of these paragraphs, a substantially responsive tender is one which conforms to all the terms and conditions of the tender documents without material deviations the Procuring entity’s determination of a tender’s responsiveness is to be based on the contents of the tender itself without recourse to extrinsic evidence.

2.20.5 If a tender is not substantially responsive, it will be rejected by the procuring entity and may not subsequently be made responsive by the tenderer by correction of the nonconformity.

2.21 Conversion to single currency

2.21.1 Where other currencies are used, the Procuring entity will convert those currencies to Kenya Shillings using the selling exchange rate on the date of tender closing provided by the Central Bank of Kenya.

2.22 Evaluation and Comparison of Tenders

2.22.1 The Procuring entity will evaluate and compare the tenders which have been determined to be substantially responsive, pursuant to paragraph 2.20.

2.22.2 The Procuring entity’s evaluation of a tender will take into account, in addition to the tender price, the following factors, in the manner and to the extent indicated in paragraph 2.22.3.

(a) Operational plan proposed in the tender;

(b) Deviations in payment schedule from that specified in the Special Conditions of Contract.

2.22.3 Pursuant to paragraph 2.22.2, the following evaluation methods will be applied.

(a) Operational Plan

(i) The Procuring entity requires that the services under the Invitation for Tenders shall be performed at the time specified in the Schedule of Requirements. Tenders offering to perform longer than the procuring entity’s required delivery time will be treated as non-responsive and rejected.

(b) Deviation in payment schedule

(i) Tenderers shall state their tender price for the payment on schedule outlined in the special conditions of contract. Tenders will be evaluated on the basis of this base price. Tenderers are, however, permitted to state an alternative payment schedule and indicate the reduction in tender price they wish to offer for such alternative payment schedule. The Procuring entity may consider the alternative payment schedule offered by the selected tenderer.

2.22.4 The tender evaluation committee shall evaluate the tender within 30 days from the date of opening the tender.

2.22.5 The tender evaluation committee shall evaluate the tender within 30 days from the date of opening the tender.

2.23. Contacting the Procuring entity

2.23.1 Subject to paragraph 2.19 no tenderer shall contact the Procuring entity on any matter relating to its tender, from the time of the tender opening to the time the contract is awarded.

2.23.2 Any effort by a tenderer to influence the Procuring entity in its decisions on tender evaluation, tender comparison, or contract award may result in the rejection of the Tenderers’ tender.

2.24 Post-qualification

2.24.1 The Procuring entity will verify and determine to its satisfaction whether the tenderer that is selected as having submitted the lowest evaluated responsive tender is qualified to perform the contract satisfactorily.

2.24.2 The determination will take into account the tenderer financial and technical capabilities. It will be based upon an examination of the documentary evidence of the

tenderers qualifications submitted by the tenderer, pursuant to paragraph 2.11.2, as well as such other information as the Procuring entity deems necessary and appropriate.

2.24.3 An affirmative determination will be a prerequisite for award of the contract to the tenderer. A negative determination will result in rejection of the Tenderer’s tender, in which event the Procuring entity will proceed to the next lowest evaluated tender to make a similar determination of that Tenderer’s capabilities to perform satisfactorily.

2.25 Award Criteria

2.25.1 Subject to paragraph 2.29 the Procuring entity will award the contract to the successful tenderer whose tender has been determined to be substantially responsive and has been determined to be the lowest evaluated tender, provided further that the tenderer is determined to be qualified to perform the contract satisfactorily.

2. To qualify for contract awards, the tenderer shall have the following:

   (b) Necessary qualifications, capability experience, services, equipment and facilities to provide what is being procured.
   (c) Legal capacity to enter into a contract for procurement
   (d) Shall not be insolvent, in receivership, bankrupt or in the process of being wound up and is not the subject of legal proceedings relating to the foregoing.
   (e) Shall not be debarred from participating in public procurement.

2.26 Procuring entity’s Right to accept or Reject any or all Tenders

2.26.1 The Procuring entity reserves the right to accept or reject any tender, and to annul the tendering process and reject all tenders at any time prior to contract award, without thereby incurring any liability to the affected tenderer or tenderers or any obligation to inform the affected tenderer or tenderers of the grounds for the Procuring entity’s action. If the Procuring entity determines that none of the tenders is responsive, the Procuring entity shall notify each tenderer who submitted a tender.

2.26.2 The procuring entity shall give prompt notice of the termination to the tenderers and on request give its reasons for termination within 14 days of receiving the request from any tenderer.

2.26.3 A tenderer who gives false information in the tender document about its qualification or who refuses to enter into a contract after notification of contract award shall be considered for debarment from participating in future public procurement.

2.27 Notification of Award

2.27.1 Prior to the expiration of the period of tender validity, the Procuring entity will notify the successful tenderer in writing that its tender has been accepted.
2.27.2 The notification of award will signify the formation of the contract subject to the signing of the contract between the tenderer and the procuring entity pursuant to clause 2.9. Simultaneously the other tenderers shall be notified that their tenders were not successful.

2.27.3 Upon the successful Tenderer’s furnishing of the performance security pursuant to paragraph 2.29 the Procuring entity will promptly notify each unsuccessful Tenderer and will discharge its tender security, pursuant to paragraph 2.12

2.28 Signing of Contract

2.28.1 At the same time as the Procuring entity notifies the successful tenderer that its tender has been accepted, the Procuring entity will simultaneously inform the other tenderers that their tenders have not been successful.

2.28.2 Within fourteen (14) days of receipt of the Contract Form, the successful tenderer shall sign and date the contract and return it to the Procuring entity.

2.28.3 The contract will be definitive upon its signature by the two parties.

2.28.4 The parties to the contract shall have it signed within 30 days from the date of notification of contract award unless there is an administrative review request.

2.29 Performance Security

2.29.1 The successful tenderer shall furnish the performance security in accordance with the Conditions of Contract, in a form acceptable to the Procuring entity.

2.29.2 Failure by the successful tenderer to comply with the requirement of paragraph 2.29 or paragraph 2.30.1 shall constitute sufficient grounds for the annulment of the award and forfeiture of the tender security, in which event the Procuring entity may make the award to the next lowest evaluated tender or call for new tenders.

2.30 Corrupt or Fraudulent Practices

2.30.1 The Procuring entity requires that tenderers observe the highest standard of ethics during the procurement process and execution of contracts. A tenderer shall sign a declaration that he has not and will not be involved in corrupt or fraudulent practices.

2. The Procuring entity will reject a proposal for award if it determines that the tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question.

2.18.2 Further a tenderer who is found to have indulged in corrupt or fraudulent practices risks being debarred from participating in public Procurement in Kenya.
Appendix to Instructions to Tenderers

The following information for the procurement of services shall complement, supplement, or amend, the provisions on the instructions to tenderers. Wherever there is a conflict between the provisions of the instructions to tenderers and the provisions of the appendix, the provisions of the appendix herein shall prevail over those of the instructions to tenderers.

<table>
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<th>INSTRUCTIONS TO TENDERERS REFERENCE</th>
<th>PARTICULARS OF APPENDIX TO INSTRUCTIONS TO TENDERERS</th>
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<tr>
<td>1 (d)</td>
<td>The Employer is: NATIONAL IRRIGATION AUTHORITY</td>
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<tr>
<td>2.1</td>
<td>ELIGIBILITY REQUIREMENTS</td>
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This invitation to tender is open to tenderers registered/incorporated in Kenya, duly registered and licensed as a contractor in water works by National Construction Authority (NCA).

The following qualification requirements MUST be FULLY met by the tenderers. The evaluation shall be on PASS/FAIL criteria and a tenderer must pass the below stated eligibility requirement in order to proceed to the next stage of mandatory preliminary evaluation. Any FAIL in any criteria shall result in overall FAIL.

i. The tenderer must submit one original and one copy of the tender in legible writing/copies.

ii. Valid registration as a legal entity in Kenya with evidence of certified copy (By Commissioner Of Oaths) of certificate of incorporation/registration and a certified copy (By Commissioner Of Oaths) of certificate from registrar of companies showing directorship and shareholding (i.e. CR12 or whichever applicable) being submitted with the tender pursuant to section 55(1) (a) of the act.

iii. A tenderer must submit with his/her tender a certified copy (By Commissioner Of Oaths) of valid NCA certificate of registration as a MECHANICAL/ELECTRICAL CONTRACTOR in atleast NCA 7 and a certified copy (By Commissioner Of Oaths) of valid NCA contractors annual practicing as a MECHANICAL/ELECTRICAL CONTRACTOR license issued by NCA to demonstrate their eligibility. (the NCA certificate will be confirmed from NCA website to confirm registration and if unregistered will lead to disqualification).
The tenderer shall provide maintenance services for the Authority’s Pumps and Generators in National Public Irrigation schemes (Mwea, Bunyala, Rwambwa Mudembii, Sisenye, Ahero, West Kano Bura Scheme, Usueni and Hola Scheme), Galana Kulalulu and Head Office for period of **two calendar years from the date of commencement of provision of the services upon satisfactory performance in year one.**

2.1.3 Tenderers shall provide the qualification information statement that the tenderer (including all members of a joint venture and sub service providers) is not associated, or have been associated in the past, directly or indirectly, with a firm or any of its affiliates which have been engaged by the Procuring entity to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the services under this Invitation for tenders.

2.2.2 Tender document may be viewed and obtained from **19th June 2020** by eligible and interested tenderers **free of charge** from the Authority’s website: http://www.nib.or.ke/tenders or GoK’s e-procurement portal, http://www.supplier.treasury.go.ke or tenders.go.ke

2.2.3 Tender document may be viewed from **19th June 2020** by eligible and interested tenderers **free of charge** from the Authority’s website: http://www.nib.or.ke/tenders or GoK’s e-procurement portal, http://www.supplier.treasury.go.ke

2.4.1 Clarification from tenderers must be received by Procuring Entity in writing, email not later than seven (7) days prior to the deadline for submission of tenders.

All clarifications shall be sought in writing and either hand delivered or e-mailed to the Procuring Entity using the address indicated in the invitation to tender.

Written copies of the responses to clarifications and addendum (addenda) shall be sent to all the tenderers who have obtained Tender Document from the Procuring Entity’s website: http://www.nib.or.ke/tenders or GoK’s e-procurement portal, http://www.supplier.treasury.go.ke using the e-mail addresses they have submitted as instructed in the invitation to tender

2.4.2 All tenderers shall be notified of all amendments using the e-mail addresses they have provided. To this end, the tenderers MUST provide functional and reliable e-mail addresses as the procuring entity will not be liable for any loss resulting from non-compliance to this requirement.

2.5.2 All prospective tenderers who have downloaded the tender documents and submitted their contact details as instructed will be notified of the amendment by email and such amendment will be binding on them

2.6.1 Any tender that is written in a language other than English shall be declared non-responsive and rejected.

2.7.1 e) Any other documents as instructed in the tender document

2.9.1, 2.9.2 & 2.9.3 **FINANCIAL EVALUATION**

(i). Tenders with Tender Form and Price Schedule not completed as prescribed shall be shall be rejected by Procuring Entity as non-responsive.

(ii). The tenderers’ tender prices MUST follow Standard Price Schedules provided in

part 4 of section V. Tenderers whose tenders do not comply fully with this requirement shall be rejected by Procuring Entity as non-responsive.

(iii). The quoted prices shall include all the costs such as Supply, Delivery to the specified site, Installation, Training, Commissioning and all applicable taxes. All applicable taxes shall be deemed to have been included in the quoted prices whether indicated so by the Tenderer or not.

*Tenders will be checked of errors, values and shall be ranked according to their evaluated price. 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.*

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Evaluation Criteria</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>Details of experience and past performance as Main contractor of a minimum 2 no. works of similar nature and complexity (involving maintenance of pumps, motors and generators) of not less than Kes.18 million each in the last 5 years. (Documentary evidence in form of Employer’s reference/Notification of Award and Certificate of Completion/Interim Certificate must be provided)</td>
<td>Mandatory</td>
</tr>
</tbody>
</table>
| ii.   | The qualifications and experience of key personnel proposed for specified roles for administration and execution of the contract both on and off site in line with the terms of reference. *CVs of proposed personnel signed in APRIL.MAY 2020 by BOTH the tenderer’s authorized representative and the personnel MUST be provided* | i. 1 No. Contract Manager, with Bsc in Civil/Mechanical/Electrical/Agricultural Engineering qualification, 10 years general experience and 5 years specific experience  
ii. 1 No. Site Engineer/Agent with Bsc Engineering (Electrical or Mechanical) qualification, 10 years general experience and 5 years...
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<tr>
<td>iii.</td>
<td>Ownership or leasing of the essential equipment listed as required for the works; (documentary evidence through log books containing the tenderer’s name <strong>ONLY</strong> for owned equipment and/or log books containing the lessor’s name <strong>ONLY</strong> for leased equipment must be provided). A complete list of equipment must be provided with their respective ratings, capacity and registration numbers.</td>
<td>PROVIDE LIST AND ATTACHMENTS OF EVIDENCE FOR;</td>
</tr>
<tr>
<td></td>
<td>i. 1 No. 8-10 Ton Flatbed Lorry</td>
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<td></td>
<td>ii. 1 No. 7-10 ton Crane Lorry</td>
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<td></td>
<td>iii. 1 No. 1 ton pick-up/utility vehicles</td>
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<td></td>
<td>iv. Portable Dewatering pump not less than 36m³/hour</td>
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</tr>
<tr>
<td>v.</td>
<td>Financial capacity in form of Liquid assets <em>(from audited financial statements for three years 2019, 2018 and 2017)</em> available for execution of this project (exclusive of any advance payments which may be made under the Contract.)</td>
<td>Minimum Kes. 20.00 Million</td>
</tr>
<tr>
<td>vi.</td>
<td>Average Annual volume of construction work in the last three years (2019,2018 and 2017) (Documentary evidence in form of Employer’s reference/Notification of Award and Certificate of Completion/Interim Certificate</td>
<td>Minimum Kes. 20.00 million</td>
</tr>
</tbody>
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<tbody>
<tr>
<td></td>
<td>vii. Adequacy of the proposed methodology and programme of entire services/works in the form of bar chart(s) in responding to the requirements</td>
</tr>
<tr>
<td></td>
<td>Mandatory</td>
</tr>
</tbody>
</table>

2.12.1 Tenders must be accompanied by tender security of an amount of **Kes. 500,000.00** in the form of a bank guarantee issued by a local reputable bank incorporated and operated in Kenya and addressed to the General Manager, National Irrigation Authority. The attached tender security form (Section VII – Standard Forms No. 5) must be used without any modification at all. Tenders with tender securities of lower amounts and in other modified forms or sources (such as guarantees from insurance companies) shall be rejected.

Tenders with tender security not valid for at least 30 calendar days beyond the tender validity period of 180 calendar days (180+30 calendar days) shall be rejected.

2.12.2 The tender security shall be in the amount of at least Kes. 500,000.00

2.12.4 Tenders must be accompanied by tender security of an amount of **Kes. 500,000.00** in the form of a bank guarantee issued by a local reputable bank incorporated and operated in Kenya and addressed to the General Manager, National Irrigation Authority. The attached tender security form (Section VII – Standard Forms No. 5) must be used without any modification at all. Tenders with tender securities of lower amounts and in other modified forms or sources (such as guarantees from insurance companies) shall be rejected.

Tenders with tender security not valid for at least 30 calendar days beyond the tender validity period of 180 calendar days (180+30 calendar days) shall be rejected.

2.13.1 Tenders shall be valid for 180 calendar days from date of tender opening.

2.14.1 One ORIGINAL Tender and 2 COPIES of tender

2.14.3 Tender with interlineations, erasures, or overwriting in which such corrections have not be initialed by the person or persons signing the tender shall be rejected by Procuring Entity as non-responsive.

2.16.3 **BULKY TENDERS WILL BE DELIVERED AT:**
 Procurement & Supplies Unit
 National Irrigation Authority (NIA)
 Unyunyizi House, Basement, Room 109

AND BIDDER’S DELIVERY BOOK MUST BE SIGNED BY STAFF RECEIVING THE TENDER

2.18.1 **15th July 2020 AT 12.00 NOON LOCAL TIME**

2.18.2 Tenders with outer envelopes not sealed and marked as required by paragraph 2.15.2 shall not be opened by the Procuring Entity.

23.1 & 23.2 The substantial responsiveness of the tender shall be determined through preliminary examination, eligibility and qualification requirements specified in the Appendix to ITB 2.1 & 2.2

**Tender Document:** Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes, NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
### MANDATORY PRELIMINARY REQUIREMENTS

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

1. **A Tenderer must submit with his/her tender a Certified (by Commissioner of Oaths) audited financial statements/accounts for the three years (2019, 2018 and 2017) and a signed declaration that the tenderer is not insolvent, in receivership, bankrupt or in the process of being wound up pursuant to Section 55 (1) (b) of the Act.**

2. **A tenderer must submit with his/her tender a signed declaration (before a Commissioner of Oaths) that the person/tenderer is not precluded from entering into a contract with the procuring entity pursuant to Section 55 (1) (d) of the Act.**

3. **A tenderer must submit with his/her tender a signed (before Commissioner of Oaths) declaration that the tenderer or associate tenderer or sub-contractor (if any) is not debarred from participating in procurement proceedings under Part XI of the Act pursuant to Section 55(1) (e) of the Act.**

4. **A tenderer must submit with his/her tender a signed declaration (before a Commissioner of Oaths) that the person/tenderer has not been convicted of corrupt or fraudulent practices pursuant to Section 55 (1) (g) of the Act.**

5. **A tenderer must submit with his/her tender a signed declaration (before a Commissioner of Oaths) that the person/tenderer is not guilty of any serious violation of fair employment laws and practices pursuant to Section 55 (1) (h) of the Act.**

6. **A tenderer must submit with his/her tender a signed declaration (before a Commissioner of Oaths) that the person/tenderer will not engage in any corrupt or fraudulent practices pursuant to Sec 62 of the Act.**

7. **A tenderer must submit with his/her tender valid tax compliance certificate from Kenya Revenue Authority.**

---

(KRA) PURSUANT TO SECTION 55 (1) (f) OF THE ACT. THE PROCURING ENTITY SHALL VERIFY THE VALIDITY OF THE TAX COMPLIANCE CERTIFICATE ON THE KRA’S iTAX PORTAL USING TCC CHECKER.

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<tr>
<td>viii.</td>
<td>A TENDERER MUST SERIALIZE HIS/HER TENDER IN THE FORMAT, PAGE X OF Y. THE TENDERERS MUST INSERT THEIR OWN SERIAL NUMBERS EVEN IN CASES WHERE THEY SUBMIT PART OR WHOLE OF TENDER DOCUMENT ALREADY SERIALIZED BY THE PROCURING ENTITY OR OTHER PRINTED AND SERIALISED DOCUMENTS PURSUANT TO SECTION 74(1) (i) OF THE ACT.</td>
</tr>
<tr>
<td>ix.</td>
<td>A TENDERER MUST SUBMIT WITH HIS/HER TENDER A POWER OF ATTORNEY TO DEMONSTRATE THAT THE TENDER HAS BEEN DULY SIGNED BY THE PERSON LAWFULLY AUTHORISED TO DO SO ON BEHALF OF THE TENDERER PURSUANT TO APPENDIX TO ITT 16.2 IN THE ISSUED TENDER DOCUMENT.</td>
</tr>
<tr>
<td>x.</td>
<td>SUBMISSION OF TENDER SECURITY IN THE AMOUNT AND FORM AS SPECIFIED IN THE TENDER DOCUMENT, APPENDIX TO ITT 2.14.1. PURSUANT TO SEC 61 OF THE ACT</td>
</tr>
<tr>
<td>xi.</td>
<td>A TENDERER MUST SUBMIT WITH HIS/HER TENDER COMPLETED AND SIGNED FORM OF TENDER ON LETTER HEAD OF THE TENDERER, APPENDIX TO FORM OF TENDER, PRICED BILLS OF QUANTITIES AND OTHER SCHEDULES AND OTHER MATERIALS REQUIRED TO BE COMPLETED PURSUANT TO APPENDIX TO ITT 9.1 IN THE ISSUED TENDER DOCUMENT.</td>
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<tr>
<td>2.21.1</td>
<td>The conversion to single currency shall not apply as all tenders will be priced in Kenya shillings and payments due under the contract shall also be paid in Kenya Shillings.</td>
</tr>
<tr>
<td>2.22.3 (b)</td>
<td>Deviation in payment schedule shall not be applicable. The successful tenderer shall be paid the amount due to him within 30 days on submission of invoice on account of the actual total value of the services and any other works executed within each month.</td>
</tr>
<tr>
<td>2.29.1</td>
<td>The performance security shall NOT BE APPLICABLE</td>
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SECTION III - GENERAL CONDITIONS OF CONTRACT

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<td>3.18.</td>
<td>Notices</td>
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</table>
3.1. Definitions

3.1.1 In this Contract, the following terms shall be interpreted as indicated:

(a) “The Contract” means the agreement entered into between the Procuring entity and the tenderer, as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

(b) “The Contract Price” means the price payable to the tenderer under the Contract for the full and proper performance of its contractual obligations.

(c) “The Services” means services to be provided by the tenderer including any documents, which the tenderer is required to provide to the Procuring entity under the Contract.

(d) “The Procuring entity” means the organization procuring the services under this Contract.

(e) “The Service provider” means the organization or firm providing the services under this Contract.

(f) “GCC” means the General Conditions of Contract contained in this section.

(g) “SCC” means the Special Conditions of Contract.

(h) “Day” means calendar day.

3.2. Application

3.2.1 These General Conditions shall apply to the extent that they are not superceded by provisions of other part of the contract.

3.3. Standards

3.3.1 The services provided under this Contract shall conform to the standards mentioned in the schedule of requirements.

3.4. Use of Contract Documents and Information

3.4.1 The Service provider shall not, without the Procuring entity’s prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the Procuring entity in
connection therewith, to any person other than a person employed by the service provider in the performance of the Contract.

3.4.2 The Service provider shall not, without the Procuring entity’s prior written consent, make use of any document or information enumerated in paragraph 2.4.1 above.

3.4.3 Any document, other than the Contract itself, enumerated in paragraph 2.4.1 shall remain the property of the Procuring entity and shall be returned (all copies) to the Procuring entity on completion of the contract’s or performance under the Contract if so required by the Procuring entity.

3.5. Patent Rights

3.5.1 The Service provider shall indemnify the Procuring entity against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the services under the contract or any part thereof.

3.6 Performance Security

3.6.1 Within twenty eight (28) days of receipt of the notification of Contract award, the successful tenderer shall furnish to the Procuring entity the performance security where applicable in the amount specified in SCC.

3.6.2 The proceeds of the performance security shall be payable to the Procuring entity as compensation for any loss resulting from the Tenderer’s failure to complete its obligations under the Contract.

3.6.3 The performance security shall be denominated in the currency of the Contract, or in a freely convertible currency acceptable to the Procuring entity and shall be in the form of:
   a) Cash.
   b) A bank guarantee.
   c) Such insurance guarantee approved by the Authority.
   d) Letter of credit.

3.6.4 The performance security will be discharged by the Procuring entity and returned to the Candidate not later than thirty (30) days following the date of completion of the Service provider’s performance of obligations under the Contract, including any warranty obligations, under the Contract.

3.7. Delivery of services and Documents

3.7.1 Delivery of the services shall be made by the Service provider in accordance with the terms specified by the procuring entity in the schedule of requirements and the special conditions of contract.

3.8. Payment

3.8.1 The method and conditions of payment to be made to the service provider under this Contract shall be specified in SCC.

3.8.2 Payment shall be made promptly by the Procuring entity, but in no case later than sixty (60) days after submission of an invoice or claim by the service provider.

3.9. **Prices**

3.9.1 Prices charges by the service provider for Services performed under the Contract shall not, with the exception of any price adjustments authorized in SCC vary from the prices quoted by the tenderer in its tender or in the procuring entity’s request for tender validity extension the case may be. No variation in or modification to the terms of the contract shall be made except by written amendments signed by the parties.

3.9.2 Contract price variations shall not be allowed for contracts not exceeding one year (12 months)

3.9.3 Where contract price variation is allowed the variation shall not exceed 10% of the original contract price

3.9.4 Price variation requests shall be processed by the procuring entity within 30 days of receiving the request.

3.10. **Assignment**

3.10.1 The Service provider shall not assign, in whole or in part, its obligations to perform under this Contract, except with the Procuring entity’s prior written consent.

3.11. **Termination for Default**

3.11.1 The Procuring entity may, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Service provider terminate this Contract in whole or in part:

   (a) if the Service provider fails to provide any or all of the services within the period(s) specified in the Contract, or within any extension thereof granted by the Procuring entity.

   (b) If the Service provider fails to perform any other obligation(s) under the Contract

   (c) If the Contract in the judgment of the Procuring entity has engaged in corrupt or fraudulent practices in competing for or in executing the contract

3.11.2 In the event the Procuring entity terminates the contract in whole or in part, it may procure, upon such terms and in such manner as it deems appropriate, services similar to those un-delivered and the Service provider shall be liable to the Procuring entity for any excess costs for such similar services. However the service provider shall continue performance of the contract to extent not terminated.
3.12. **Termination for Insolvency**

3.12.1 The Procuring entity may at any time terminate the contract by giving written notice to the Service provider if the service provider becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the service provider, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to the procuring entity.

3.13. **Termination for Convenience**

3.13.1 The Procuring entity by written notice sent to the service provider may terminate the contract in whole or in part, at any time for its convenience. The notice of termination shall specify that the termination is for the procuring entities convenience, the extent to which performance of the service provider of the contract is terminated and the date on which such termination becomes effective.

3.13.2 For the remaining part of the contract after termination the procuring entity may elect to cancel the services and pay to the service provider an agreed amount for partially completed services.

3.14 **Resolution of Disputes**

3.14.1 The procuring entity and the service provider shall make every effort to resolve amicably by direct informal negotiations and disagreement or disputes arising between them under or in connection with the contract

3.14.2 If after thirty (30) days from the commencement of such informal negotiations both parties have been unable to resolve amicably a contract dispute either party may require that the dispute be referred for resolution to the formal mechanisms specified in the SCC.

3.15. **Governing Language**

3.15.1 The contract shall be written in the English language. All correspondence and other documents pertaining to the contract, which are exchanged by the parties shall be written in the same language.

3.16. **Applicable Law**

3.16.1 The contract shall be interpreted in accordance with the laws of Kenya unless otherwise expressly specified in the SCC.

3.17 **Force Majeure**

3.17.1 The Service provider shall not be liable for forfeiture of its performance security, or termination for default if and to the extent that its delay in performance or other
failure to perform its obligations under the Contract is the result of an event of Force Majeure.

3.18 Notices

3.1.1 Any notices given by one party to the other pursuant to this contract shall be sent to the other party by post or by Fax or Email and confirmed in writing to the other party’s address specified in the SCC.

3.1.2 A notice shall be effective when delivered or on the notices effective date, whichever is later.
SECTION IV - SPECIAL CONDITIONS OF CONTRACT
### Special Conditions of Contract as relates to the General Conditions of Contract

<table>
<thead>
<tr>
<th>Reference of general conditions of contract</th>
<th>Special condition of contract</th>
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<tr>
<td>3.6 Performance security</td>
<td>The performance security shall NOT BE APPLICABLE</td>
</tr>
<tr>
<td>3.7 Delivery of Services</td>
<td>Services to be offered as described in the schedule in the schedule of requirements.</td>
</tr>
<tr>
<td>3.8 Payment</td>
<td>The successful tenderer shall be paid the amount due to him on account of the services provided and any other works executed within each month. The rates quoted shall be used in computation of the amount. <strong>Other payments terms and conditions that may be proposed by tenderers shall not be accepted.</strong></td>
</tr>
<tr>
<td>3.9 Price adjustment</td>
<td>Not Applicable unless occasioned by changes in the Laws of Kenya</td>
</tr>
<tr>
<td>3.16 Applicable law</td>
<td>Laws of Kenya.</td>
</tr>
<tr>
<td>3.18 Notices</td>
<td><strong>EMPLOYER:</strong> CHIEF EXECUTIVE OFFICER NATIONAL IRRIGATION AUTHORITY LENANA ROAD UNYUNYIZI HOUSE P.O.BOX 30372-00100 NAIROBI TEL: 254-20-2711380/468 FAX: 254-20-2722821/2711347 E-MAIL : <a href="mailto:nib@nib.or.ke">nib@nib.or.ke</a> <strong>TENDERER:</strong></td>
</tr>
</tbody>
</table>
SECTION V - SCHEDULE OF REQUIREMENTS

NOTE: The Tenderer shall provide services for the for initial period of one calendar year with a provision for extension as would be determined by the Procuring Entity depending on the satisfactory performance, needs of the Authority and availability of funds.

1. OBJECTIVE OF THE SERVICE
The objective is to outsource the maintenance services of the pump station so that the repairs and maintenance of the pumps and associated installations are carried out by a contracted service provider.

2. SCOPE OF WORK
In order to realize the objective stated above, the Authority wishes to secure the services of a specialist to carry out the works on contract basis. The pumps at the stations are simply an assembly of machines that mainly includes a prime mover (engine), gearbox, or motor and the pumping unit. Each of these is subject to wear and tear during operation and therefore routine maintenance is necessary and should be done as prescribed by the manufacturer in the service manuals. The Authority shall avail the service manuals to the specialist and also provide a history of maintenance of the existing pumps so as to facilitate smooth and correct maintenance measures for the pump sets. A maintenance schedule as in the tables below shall be used in carrying out the maintenance of the pumps. Proper maintenance records shall be kept and availed to the engineer for verification.

3. PERSONNEL
During repairs troubleshooting, dismantling and assembling of any component of the pumping station shall be done by a qualified mechanic. The Authority shall however not control the staff of the Service Provider provided that he/she shall take professional and operational responsibility for the executed works.

4. EXPECTED OUTPUTS
The expected outputs of the contract will be as follows: -

a) All the pumps and generators in the stations will be in good condition at all times. Supply of irrigation water as per the provided schedule will not be interrupted by pump operation related problems.

b) Reports on repairs and maintenance to be prepared and submitted to the Authority on monthly basis.

5. RESPONSIBILITIES OF THE SERVICE PROVIDER
The Service Provider shall be responsible for the maintenance and shall ensure that all required personnel, equipment, materials and other facilities are available as and when required for the smooth implementation of the works. The Service Provider shall ensure that the station is operating optimally and shall be responsible for all equipment and tools entrusted to him/her. The Service Provider shall be responsible for the preparation and submission of reports in a format prescribed by the Engineer.

6. RESPONSIBILITIES OF NIA
NIA shall be responsible for:

a) Assess, review and grant approvals for expenses exceeding an agreed amount of money during repairs.

b) Monitor and evaluate performance of the Service Provider.

c) Payment of any fees due to the Service Provider in line with the agreed terms of payment.

7. PROGRAM OF WORKS
The Service Provider shall prepare a maintenance schedule using the projected irrigation schedule prepared by the engineer. In case of repairs, the Service Provider will prepare a program of works.

8. DETAILS OF STATIONS, PUMPS, GENERATORS AND ASSOCIATED INSTALLATIONS

8.1 BURA IRRIGATION SCHEME PUMP STATION AT NANIGHI

Bura Irrigation Settlement Scheme is situated along the Tana River in Tana River District, Coast Province. It is 50km North of Hola Town and about 400 kilometers North-West of Mombasa Town. The scheme has a pump fed irrigation system whose pump station is located 50km from the scheme offices at Nanigi. The pump station currently has 4 sets of pumps two that are old and two that are fairly new (under installation). The pumps lift water from a lagoon that draws water from Tana River to a sedimentation basing that feeds the main canal.
Vertical Submersible pumps.

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<tr>
<td>Make</td>
<td>ABS Germany (Manufactured 2007 and 2012)</td>
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<td></td>
<td>Discharge 2.7m³/s.</td>
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</table>

Features
- Propeller/impeller
- Diesel Generators 6no. – Volvo rating 280KW and 350KVA each
- Rising Mains and delivery pipes
- Electric panel

The pump station also has a pump deck, generator house, parts store and a fuel tank.

8.2 HOLA IRRIGATION SCHEME PUMP STATION AT MAKERE

The scheme has a pump fed irrigation system whose pump station is located 20km from the scheme offices. The pump station currently has 10 sets of pumps all installed in 2009. The pumps lift water directly through suction pipes from Tana River to a sedimentation basing that feeds the main canal. The pumps are driven by 3no diesel generators. The pumps in the station are all centrifugal pumps.

Below are details of the pumps in the station:

Pump features:

<table>
<thead>
<tr>
<th>No</th>
<th>10no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make</td>
<td>KSB</td>
</tr>
<tr>
<td></td>
<td>Discharge 330 l/s</td>
</tr>
</tbody>
</table>

Features
a) One impeller
b) Motor – 33kw
c) Volute
d) Suction and Delivery Pipes

Generators

<table>
<thead>
<tr>
<th>No</th>
<th>3no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make</td>
<td>John Deere</td>
</tr>
<tr>
<td></td>
<td>Rating – 350KVA</td>
</tr>
<tr>
<td></td>
<td>Electric Panel</td>
</tr>
</tbody>
</table>

The pump station also has a pump deck, generator house, parts store and a fuel tank.
8.3 AHERO IRRIGATION SCHEME
Ahero irrigation scheme is situated in Kano Plains in Nyando District, Nyanza Province District along the Kisumu Nairobi road. The scheme became operational in 1969 as a pilot irrigation project with a pump fed system. The scheme ceased to operate in 1999 due to the unserviceable condition of the pumps.

8.4 DESCRIPTION OF AHERO PUMP STATION
The station is the main supply of irrigation water and abstracts water from River Nyando. The station has four pumps, a pump house (switch room), pump deck, storage containers and a guard house. Vertical Submersible Axial flow pump and submersible radial flow pumps.

Submersible Pumps

<table>
<thead>
<tr>
<th>No</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>P No 4 – 4no</td>
<td>(660l/s Design Discharge- ABS (axial flow pumps)- P3&amp;4(1,100l/s Design Discharge – Grundfos (radial flow pumps)-P1&amp;2)</td>
</tr>
<tr>
<td>P No 3.</td>
<td>ABS manufactured in 2006, P No 3, ABS to be purchased and P No.1&amp;2 – Grundfos, manufactured in 2011)</td>
</tr>
<tr>
<td>P No 1&amp;2</td>
<td>Grundfos, manufactured in 2011)</td>
</tr>
</tbody>
</table>

Features

a) Propeller
b) Submersible Motor; Rating 110kw/120Kw (Electric Driven)
c) Raising mains and delivery pipes
d) Electric Panel

8.5 WEST KANO IRRIGATION SCHEME
West Kano irrigation scheme is situated in Kano Plains along shores of Lake Victoria in Nyando District, Nyanza Province. The scheme became operational in 1976 as a pilot irrigation project with a pump fed and drained system. The scheme’s source of irrigation water is Lake Victoria whereby, water is conveyed from the lake though a link canal to a lagoon for onward pumping into the schemes main canal. The scheme drainage system is also enhanced through pumping where drainage water collects at a lagoon and pumped out by pumps installed at the outlet pumping station. The scheme ceased to operate in 1999 due to the unserviceable condition of the pumps. In 2003, the Board rehabilitated the inlet pump station and this saw resumption of cropping in the scheme.

8.5.1 DESCRIPTION OF INLET PUMP STATION
The station is the main supply of irrigation water and abstracts water from Lake Victoria. The station has three pumps mounted on a floating pontoon, a pump house (switch room) and a pump deck. The pump details are as below:

**Vertical Submersible Pumps**

- **Make**: ABS Germany (Manufactured 2006 (2) and 2007(1))
- **Discharge**: (750l/s Design Discharge)

**Features**

- a) Propeller
- b) Submersible Motor; Rating 75kw (electric driven)
- c) Raising mains and delivery pipes
- d) Electric Panel
- e) Floating Pontoon

---

8.5.2 **BRIEF DESCRIPTION OF OUTLET PUMP STATION**

The station enhances drainage at the scheme by pumping out accumulated from a lagoon at the outlet drainage water to the lake. The station has three serviceable pumps. Two of the three were installed during construction of the scheme and therefore are fairly old. They are inclined axial flow pumps with surface motors coupled to the pump by a propeller shaft. The third pump is a vertical axial flow pump that was installed in 2008 so as to increase the reliability especially during flood seasons. The pump details are as below:

**Submersible Pumps features.**

- **Make**: ABS Germany (Manufactured 2008)
- **Discharge**: (P1=250l/s, P2= 300l/s & P4=P5 =500l/s Design Discharge)

**Features**

- a) Propeller
- b) Submersible Motor; Rating 37kw, 40Kw and 54kw (Electric Driven)
- c) Raising mains and delivery pipes
- d) Electric Panel

Other features in the station are a pump deck, sump for vertical submersible pump, switch room and a pump canopy.
8.6 BUNYALA IRRIGATION SCHEME
Bunyala irrigation scheme is situated North of Yala swamp in Budalangi Sub-county in Western Kenya province and is 120km from Kisumu town. The scheme became operational in 1969 as a pilot irrigation project with a pump fed system. The scheme’s source of irrigation water is River Nzoia whereby, water is lifted to the main canal by pumps. The scheme ceased to operate in 1999 due to the unserviceable condition of the pumps. In 2004 a Rapid Results Initiative (RRI) was launched to see resumption of cropping in the scheme within 100days. During this initiative the Board revamped the pumping station by rehabilitating the existing pumps. In 2006 the Board replaced 2 old pumps with 2 new ones and in 2007 two more pumps were installed. The four new pumps are vertical submersible axial flow pumps with a discharge of 300l/s each and mounted in sumps that draw water from River Nzoia.

8.6.1 DESCRIPTION OF BUNYALA PUMP STATION
The station is the main supply of irrigation water and abstracts water from River Nzoia. The station has four pumps mounted in a sump, a pump house (switch room), pump deck and a storage container. The pump details are as below:

**Vertical Submersible Pumps**

<table>
<thead>
<tr>
<th>No</th>
<th>Make</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>4no</td>
<td>ABS Germany (Manufactured 2006 (2) and 2007(2))</td>
<td>(300l/s Design Discharge)</td>
</tr>
</tbody>
</table>

**Features**

a) Propeller/impeller
b) Submersible Motor; Rating 45kw (Electric Driven)
c) Raising mains and delivery pipes
d) Electric Panel

8.6.2 RWAMBWA MUDENMBI IRRIGATION SCHEME
Bunyala irrigation scheme is situated North of Yala swamp in Budalangi Sub-County in Western Kenya province and is 120km from Kisumu town. The scheme started as a community initiative to practice irrigated agriculture and used a pump donated by a local NGO to supply water for irrigation. In 2007 upon request by the scheme’s farmers and after assessing the potential for irrigation, the Board installed 2no Submersible centrifugal pumps each with a capacity of 150l/s mounted in a sump that draws water from River Nzoia.
8.6.3 DESCRIPTION OF RWABWA MUDEMBI PUMP STATION

The station is the main supply of irrigation water and abstracts water from River Nzoia. The station has four pumps mounted in a sump, a pump house (switch room), and a pump deck. The pump details are as below:

**Vertical Submersible Pumps**

<table>
<thead>
<tr>
<th>No.</th>
<th>Make</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>ABS Germany (Manufactured 2007)</td>
<td>(150 l/s Design Discharge) each</td>
</tr>
</tbody>
</table>

**Features**

- a) Propeller/impeller
- b) Submersible Motor; Rating 22kw (Electric Driven)
- c) Raising mains and delivery pipes
- d) Electric Panel

8.7 SISENYE IRRIGATION SCHEME

The station is the main supply of irrigation water and abstracts water from Lake Victoria. The project commenced in 2012 with the first crop being realized in 2017. The station has 2 No. pumps mounted in a sump and a pump house (switch room). Pump details are as below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Make</th>
<th>Model</th>
<th>Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>KSB</td>
<td>ETA 250-40</td>
<td>1044m³/h</td>
</tr>
</tbody>
</table>

**Features**

- a) Impeller
- b) Raising mains and delivery pipes
- c) Electric driven
- d) Electric Panel

8.8 USUENI IRRIGATION SCHEME

Usueni Irrigation Scheme is located in Kitui County, Mwingi North Constituency along Mwingi-Tseikuru-Wikithuki road 120km from Mwingi town. The scheme abstracts its irrigation water from River Tana through an electric pumping unit to a 2no receptor basins from where it is distributed to the fields through concrete lined canals. The pumping unit consists of:

6no pumps (4no at the intake, one at the booster and one standby.)

**Tender Document:** Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes, NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
Type: non submersible pumps

It's an electric driven system with a set of control panels.

8.9 GALANA KULALU FOOD SECURITY PROJECT

The Galana/Kulalu project is located in Kenya’s Coastal region and spans through the semi-arid regions of the Tana River and Kilifi Counties. The project was unveiled in 2014 as a one-Million-acre model farm. The pumping of water at Galana Kulalu Food Security Project comprises of nine pumping units. Seven of the Units are Vertical turbine pumps while the other two are Centrifugal Pumps. All the pumps convey the water to the farm through a central filtration unit. There are two types of irrigation systems,

a) Centre Pivot system – No. 20 CPs
b) Drip Irrigation System

Each Centre Pivot has a Generator (Perkins Generator 15 kVA E1S13M E/4) as the source of power for its motion.

Below is a breakdown for the working pumps at GKFSP:

PREVIOUSLY INSTALLED PUMPS (BY THE CONTRACTOR – GREEN ARAVA)

Vertical Submersible pumps.

<table>
<thead>
<tr>
<th>No</th>
<th>-</th>
<th>5 no</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make</td>
<td></td>
<td>15EHM</td>
</tr>
</tbody>
</table>
|     |   | Discharge 600 m3/hr.

Features

- 3 five – stage vertical turbine pumps , and 2 three – stage vertical turbine pumps
- Differential Gear drive with ratio of 1:1 - 4 no. (Type G350A)
- Doosan engines
  - Three v - Engines of 492 HP (Type P158LE – 1)
  - Three Inline Engines of 400 HP (Type PU126Ti)
- Propeller shaft – 8 No.

The pump station also has a sump, and attached fuel tanks of 1000L capacity each.
1.1.1 NEWLY INSTALLED PUMPS

Centrifugal Pumps

No. – 2 No. Centrifugal pumps
Make – Rovatti, Year 2015 Italy make
Type – SN5E 150 – 500 - E

Features

One Impeller
Engine driven – 400 HP (Type P158LE-1) – Two Doosan Engines
Suction and Delivery pipes

VERTICAL SUBMERSIBLE PUMPS UNDER INSTALLATION

No – 2 No
Make – Caprari Italy
Type – P16C/10/55/5B
Motor driven (250 kW) – Make Seipee, YoM 2017

NB: Generators and control panels installation and cabling yet to be done.

9. SCOPE OF MAINTANANCE AND SERVICE

9.1 MAINTENANCE

The service and maintenance to be carried out on the equipment will be based on Preventive Maintenance and Breakdown Calls.

9.2.1 Preventive maintenance: Quarterly.
The entire pumping station will be checked quarterly. During the visits, a series of checks and security maintenance will be carried out on the equipment.

9.2.2 Breakdown calls
This involves attendance during contracted hours, upon written or oral instruction by PROCURING ENTITY or authorized agents, to carry out a repair of a defective or broken down equipment. The service provider shall be required to respond to this instruction promptly but not later than 24 hours after the instruction. Instructions issued by the Procuring Entity or its authorized agents shall be in writing (hand delivered to the service provider through hand delivery or e-mail and other electronic means) provided that if for any reason,
the Procuring Entity or its authorized agents consider it necessary to issue such request orally, then the service provider shall comply with such instruction. Confirmation in writing of such oral instruction given by Procuring Entity or its authorized agents shall be deemed to be an instruction provided further that, within 2 days, the service provider confirms to the Procuring Entity or its authorized agents any oral instruction and such confirmation is not contradicted by the Procuring Entity or its authorized agents is not contradicted in writing within 2 days by the Procuring Entity or its authorized agents.

9.2 GENERAL CONDITIONS OF MAINTENANCE

Routine maintenance will include the following:

a) Physically inspect the whole pumping station including delivery lines, cabling, connection boxes and pumps and repair / report any defect.

b) Remove the pump from its column and inspect the cables, volute and impeller. Repair/report as necessary.

c) Inspect the intake; remove any matter interfering with the normal operation of the intake; check siltation and remedy where possible.

d) Test and repair where necessary the safety features of the pumping station

e) Inspection of the whole electrical installation of the outlet,

f) Inspect and repair where necessary the control panel and its accessories. Test all features of the control panel and correct where necessary.

g) Connection of electrical cables and presence of glands – Tighten or replace if necessary

h) Replacement of the defective parts (Parts will be charged separately)

i) Check the performance of power factor and make report/recommendations

j) Once a year, two coats of paints will be applied to the pumping station together with general site cleaning.

Service Provider shall ensure that materials used and works done are in accordance with regulations in force. Where equipment requires an overhaul, Service Provider shall provide a report to enable Procuring Entity to take decision for its repair to be effected. Where the equipment was not sold by Service Provider, the spare parts will be acquired from the local agents. If this is not readily available, Service Provider will not be held responsible for any delays and may offer to replace the equipment upon an agreed quotation to Procuring Entity.
Every new piece of equipment to be included in the present Contract shall be inspected and listed.

9.3 DETAILED SCHEDULES FOR THE COMPONENTS.

8.9.1 Pump Maintenance schedule.

<table>
<thead>
<tr>
<th>Item</th>
<th>500HRS</th>
<th>1000HRS</th>
<th>5000HRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Water Pumps.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Pumping unit (Vertical Submersible)</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>b. Pumping Unit i.e. shafts and dry run motors for inclined pump system</td>
<td>Normal</td>
<td>Normal</td>
<td>Above Normal</td>
</tr>
<tr>
<td>c. Sump</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>d. Raising mains</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>ii. Electric Generators and diesel Engines</td>
<td>Minor</td>
<td>Medium</td>
<td>Major</td>
</tr>
<tr>
<td>iii. Electric Motors</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>iv. Electric Panel</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Other Facilities.</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>

9.3.2 Description of the Normal Service.

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Pumps</td>
</tr>
</tbody>
</table>
| a. Pumping unit (Vertical Submersible) | - Remove the pump from the raising mains for visual inspection  
- Inspect for defects on cables, impeller, volute, casing, glands  
- Check condition of glands and electric connections  
- Check for foreign materials  
- Check Propeller play for wobbling and lubrication of the bearings. |
<table>
<thead>
<tr>
<th></th>
<th>b. Pumping Unit i.e. shafts and dry run motors for inclined pump system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Run pumps under load and record parameters.</td>
</tr>
<tr>
<td></td>
<td>- Inspect for defects on cables, glands</td>
</tr>
<tr>
<td></td>
<td>- Check condition of glands and electric connections</td>
</tr>
<tr>
<td></td>
<td>- Check for foreign materials</td>
</tr>
<tr>
<td></td>
<td>- Check impeller’s play for wobbling and lubrication of the bearings.</td>
</tr>
<tr>
<td></td>
<td>- Run pumps under load and record parameters.</td>
</tr>
<tr>
<td></td>
<td>- Check the motor coupling and replace the rubber buffers or coupling rubber as necessary</td>
</tr>
<tr>
<td></td>
<td>c. Sump</td>
</tr>
<tr>
<td></td>
<td>- Check silt levels and debris and de-silt or clean as necessary</td>
</tr>
<tr>
<td></td>
<td>- Check condition of the screen</td>
</tr>
<tr>
<td></td>
<td>d. Raising mains and delivery pipes</td>
</tr>
<tr>
<td></td>
<td>- Check connections, flanges and bolts, adjust where necessary</td>
</tr>
<tr>
<td></td>
<td>- Check anchoring to the sump walls.</td>
</tr>
<tr>
<td></td>
<td>Control Panel</td>
</tr>
<tr>
<td></td>
<td>- Inspection of the whole electrical installation</td>
</tr>
<tr>
<td></td>
<td>- Check main distribution Board, test of all functions and security devices</td>
</tr>
<tr>
<td></td>
<td>- Check connection of electrical cables and presence of glands and tighten or replace if necessary</td>
</tr>
<tr>
<td></td>
<td>- Blow accumulated dust particles and clean contacts where possible as necessary.</td>
</tr>
<tr>
<td></td>
<td>- Check the effectiveness of the power factor to ensure efficient use of power during operation.</td>
</tr>
<tr>
<td></td>
<td>- Replace broken or misplaced operation knobs.</td>
</tr>
<tr>
<td></td>
<td>- Replace defective parts.</td>
</tr>
<tr>
<td></td>
<td>Electric Motor</td>
</tr>
<tr>
<td></td>
<td>- Visual Inspection of the whole motor</td>
</tr>
<tr>
<td></td>
<td>- Check connections of all cables and cable glands</td>
</tr>
<tr>
<td></td>
<td>- Check water tightness for submersible motors</td>
</tr>
</tbody>
</table>

### Other Facilities

- Check main columns and delivery pipes for leaks or looseness
- Paint the pumping station once a year (Pipes, structure, building)
- Tidy up the place and get rid of disposable materials

### 9.3.3 Description of Minor Service for Generators and engines

<table>
<thead>
<tr>
<th>Item</th>
<th>Generators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Visual Inspection</td>
</tr>
<tr>
<td></td>
<td>- Coolant/water level (top up as necessary)</td>
</tr>
<tr>
<td></td>
<td>- Check radiator for leaks.</td>
</tr>
<tr>
<td></td>
<td>- Change Oil as necessary</td>
</tr>
<tr>
<td></td>
<td>- Check V-belt for tightness</td>
</tr>
<tr>
<td></td>
<td>- Change Fuel filter</td>
</tr>
<tr>
<td></td>
<td>- Change Oil filter</td>
</tr>
<tr>
<td></td>
<td>- Check Air filter and clean as necessary</td>
</tr>
<tr>
<td></td>
<td>- Check Oil leaks in joints (tighten if necessary)</td>
</tr>
<tr>
<td></td>
<td>- Check Battery’s water level and voltage</td>
</tr>
<tr>
<td></td>
<td>- Check earthing and clean electrical panels and relays</td>
</tr>
<tr>
<td></td>
<td>- Check circuitry confirming that all connections are firm and cables in good condition</td>
</tr>
<tr>
<td></td>
<td>- Run the generator and check good running of the equipment. Record running parameters and compare to theoretical.</td>
</tr>
</tbody>
</table>

### 9.3.4 Description of Medium service for generators and engines

<table>
<thead>
<tr>
<th>Item</th>
<th>Generators and engines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Visual Inspection</td>
</tr>
<tr>
<td></td>
<td>- Check radiator for leaks and clean replace coolant.*</td>
</tr>
</tbody>
</table>
- Change Oil as necessary
- Check V-belt for tightness
- Change Fuel filter
- Change Oil filter
- Change Air filter,*
- Check Oil leaks in joints (tighten if necessary)
- Check Battery’s water level and voltage
- Check earthing and clean electrical panels and relays
- Check circuitry confirming that all connections are firm and cables in good condition
- Run the generator and check good running of the equipment. Record running parameters and compare to theoretical.

*Items that are added to minor service.

### 9.3.5 Description of Major Service for Generators and engines

<table>
<thead>
<tr>
<th>Item</th>
<th>Generators and engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Visual Inspection</td>
<td>- Check radiator for leaks and clean replace coolant.</td>
</tr>
<tr>
<td>- Change Oil as necessary</td>
<td>- Change V-belt.*</td>
</tr>
<tr>
<td>- Change V-belt.*</td>
<td>- Change Fuel filter</td>
</tr>
<tr>
<td>- Change Oil filter</td>
<td>- Change Oil filter</td>
</tr>
<tr>
<td>- Change Air filter,</td>
<td>- Change Air filter,</td>
</tr>
<tr>
<td>- Check Oil leaks in joints (tighten if necessary)</td>
<td>- Check Oil leaks in joints (tighten if necessary)</td>
</tr>
<tr>
<td>- Replace Battery*</td>
<td>- Replace Battery*</td>
</tr>
<tr>
<td>- Check earthing and clean electrical panels and relays</td>
<td>- Check earthing and clean electrical panels and relays</td>
</tr>
<tr>
<td>- Check circuitry confirming that all connections are firm and cables in good condition</td>
<td>- Check circuitry confirming that all connections are firm and cables in good condition</td>
</tr>
<tr>
<td>- Run the generator and check good running of the equipment.</td>
<td></td>
</tr>
</tbody>
</table>

During periods of no operation, the components should be inspected at least once every quarter (three months) inspection of the components will entail the least of the service that is normal for the other facilities and minor for the engines and the generators. The cost should include the cost of consumables such as oils, filters and other service parts that do not constitute the major cost.

**NOTE: Warranty for equipment not supplied and installed by SERVICE PROVIDER**

The Supplier of the equipment will provide warranty for the spares and expenses. Consequently, **SERVICE PROVIDER** will not be held responsible if the spares cannot be supplied by the local agents for normal use in the contract or for warranty. Therefore, agreement with the different suppliers of equipment may require **PROCURING ENTITY’s** assistance. In that case, no penalty can be applied to **SERVICE PROVIDER** for out of contract response time.

**9.4 RESPONSE TIME**

It is agreed that the **SERVICE PROVIDER** shall receive and note all calls from **PROCURING ENTITY** during normal working hours, register instructions and commit to make necessary arrangements to remedy issues raised by **PROCURING ENTITY** that relate to this contract within six (6) hours of notification.

**8.9.2 Working Hours**

Normal working hours to receive calls are: Monday to Sunday : 8.00 am to 11.30 pm

Normal working hours for intervention are: Monday to Sunday : 8.00 am to 6.00 pm

**9.4.2 Outside Contracted Hours**

Should Service Provider be requested by Procuring Entity to carry out works on a public holiday or beyond the normal schedule for whatever reason, Service Provider shall make a charge based on time spent on the job and transport for the job based on the price schedule.
9.4.3 Stand By Team on Public Holidays
It is agreed in the Agreement that, during Public holidays, the SERVICE PROVIDER undertakes to provide a stand-by service centre team.
Working Hours: 8.00am – 5.00pm

9.5 RECORD KEEPING
The records for maintenance work both routine and breakdown calls authenticated by the Scheme Engineer shall be submitted to the Procuring Entity both at the Scheme and the Head Office.

8.9.3 Performance Reporting Procedures: (Key Performance Indicators)
It is agreed that both technical services of Procuring Entity and Service Provider will meet every 3 months. Service Provider will give at this time a complete report showing the performance of the Contract as detailed.

9.5.2 Performance of Preventive Maintenance Actions
The measure will show the difference between the forecast done for each month for preventive maintenance visits and the effective realisation each month.

9.5.3 Performance of Corrective Maintenance Actions
This figure will show the number of successful and unsuccessful intervention out of response time (nor) against the Procuring Entity number of intervention (TNI). Service Provider will strictly explain the reasons for any intervention out of response time. Solutions will be proposed by Service Provider to Procuring Entity to improve the situation where necessary.

9.5.4 Black Spots
A list of the black spots will be proposed: list of the stations where the number of calls is above the normal rate. Actions will be proposed by either Service Provider, or Procuring Entity, or both in order to solve the problem.
### SECTION VI: SPECIFICATIONS

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<th>Description</th>
<th>Page</th>
</tr>
</thead>
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<td>57</td>
</tr>
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<td>1.1</td>
<td>General Description of the Works</td>
<td>57</td>
</tr>
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<td>1.2</td>
<td>Location of the Works and Access</td>
<td>57</td>
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<td>1.3</td>
<td>Climatic Conditions</td>
<td>57</td>
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<td>1.4</td>
<td>Drawings and Documents</td>
<td>58</td>
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Appendix A  Engineers office and Housing – floor areas

Appendix B  Furniture for the Engineer’s Office and Accomodation
GENERAL

General Description of the Works

The main works to be undertaken under this Contract comprise the following:

(a) Construction of a 6240 cu.m. dam Earth dam 14m high, 330m long and 70m wide and reinforced concrete spillway.
(b) The intake works comprising an intake, sump
(c) 2No. Sedimentation basins.
(d) Construction of gravity pipelines comprising of conveyance, mains, sub-mains and distribution pipelines as presented below:

<table>
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<th>Quantity</th>
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<td>Main Conveyance, 630mm dia, uPVC.</td>
<td>m</td>
<td>1750</td>
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<td>2</td>
<td>Main pipelines 630 – 160mm dia UPVC</td>
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<td>13,380</td>
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<tr>
<td>3</td>
<td>Sub main pipelines, various diameters, uPVC</td>
<td>m</td>
<td>21,700</td>
</tr>
<tr>
<td>4</td>
<td>Distribution pipelines, various diameters, uPVC</td>
<td>m</td>
<td>92,800</td>
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</table>
(e) Construction of drip infield system comprising of hydrants, laterals and infield drip irrigation system for 1000 ha net area.

Location of the Works and Access

The proposed Upper Subukia Irrigation Development Project is located approximately between longitude 36° 12’ and 36° 12’ East and latitude 00° 03’ and 00° 09’ North of the Equator, in Wiyumiririe and Simboiyo sub locations of Ol Manyatta Location and Nyamamithi and Lari sub locations of Wesges Location. The two locations are in Mbogoini Division, Subukia Sub County of Nakuru County. The gross and net irrigation areas are 2354 and 1000 ha.

The area lies It is situated approximately 200 km from Nairobi along a Class A104 road and is best accessed from the Subukia – Kiboronjo earth road that branches from the Subukia – Nyahururu tarmac road at Subukia town.

Climatic Conditions

The climate in the area is arid to semi arid regimes except in the moist highlands around Subukia. The climatic conditions are strongly influenced by the ITCZ (Inter Tropical Convergence Zone) and there are two distinct wet and dry seasons. The district has a mean annual rainfall of 1066 mm with one rainy season. The annual average rainfall in the district 1066 mm with 69% of the rainfall being received in the period April to August. The wettest month is August with an average of 185 mm while January is the driest with only 22 mm. Dry months to be considered for irrigation are October, November, December and January. For most months except from mid-April to mid-September, evaporation values exceed the rainfall received in the area. Irrigation is necessary for the dry periods for crops to grow to maturity successfully. The mean daily open pan evaporation is 3.63 mm/day with the highest of 4.49 mm/day and lowest at 3.02 mm/day


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being experienced in February and July respectively. Mean daily temperatures range from 15.4°C to 16.85°C with highest temperatures being experienced in March and the lowest in July to August. The mean monthly minimum and maximum values are given in Table 2.2.

Figure 1: Temporal Distribution of Rainfall and ETo

The evaporation data used for the study was from the Muhuru bay met station. The highest monthly evaporation is in the months of March 201 mm and October 206 mm.

The seasonal variation of prevailing wind run is weakest in the month of July at 112 km/day (5 km/hr) and highest in March and October at 156 km/day (6.5km/hr). Annual average daily wind run for is 140 km/day (5.8 km/hr).

Drawings and Documents

The drawings listed in Section 5 of the Tender Documents and any modifications to those drawings and any other drawings that may be prepared by the Contractor and approved by the Engineer shall subsequently become the Contract Drawings.

For the purpose of carrying out the Contract, the Contractor will be provided with 2 sets of the Contract Documents and full size (A1) Contract Drawings.

Drawings Designed by the Contractor

All drawings, calculations, plans, reports, instruction manuals, pamphlets, data and all other documents required to be submitted by the Contractor under the Contract shall be clear and readable. The Contractor shall submit these drawings and documents in a logical order to the Engineer for review or approval at least fifty six (56) calendar days prior to execution of the Works.

All shop drawings, including field erection, layout and construction details shall be furnished by the Contractor for the approval of the Engineer.
All the drawings and calculation to substantiate the design shall be checked, signed and approved by the Contractor prior to submission. The drawings shall also be signed by a qualified engineer responsible for the design.

Approval of the drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method and detailing is satisfactory. The approval by the Engineer shall not relieve the Contractor of the requirements of the Contract or responsibility for correct installation and assembly of parts in final position or responsibility for the adequacy of the method of construction.

All the cost thereof will be deemed to be included in the Contractor’s unit rates and Contract Price.

“As Built” Drawings

Within sixty (60) days after the receipt of the Completion Certificate, the Contractor shall submit to the Engineer all the approved drawings and documents (including operation and maintenance manuals), clearly revised and brought up to date by the Contractor to show the permanent construction actually made. The submission shall be made in the following manner and quantity:

(a) One (1) set of the A1 size reproducible drawings on high quality polyester transparent film or similar material,
(b) One (1) bound set of reduced size, clearly photocopied drawings with hard cover (A3 size).

The submission shall contain the drawing index.

No separate payments will be made for the provision of the drawings as the cost thereof shall be deemed to be included in the unit rates and the Contract Price.

Standard Specifications

For convenience, and in order to establish the necessary standards of quality, reference will be made to specifications issued by national or other widely recognised bodies. Such specifications shall be referred to as “Standard Specifications” and shall be the latest editions of such Standard Specifications issued prior to the issue of Tender Documents, together with such additions and amendments as may have been issued prior to the same date.

Subject to the written approval of the Engineer, any other internationally accepted standard which requires an equal quality of work may be used.

In referring to Standard Specifications, the following abbreviations are used:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>British Standard</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organisation for Standardisation</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highways and Transportation Officials</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>ASA</td>
<td>American Standards Association</td>
</tr>
<tr>
<td>KS</td>
<td>Kenya Standard</td>
</tr>
<tr>
<td>EN</td>
<td>Normalised European Standards</td>
</tr>
</tbody>
</table>

In cases where no particular Specification or Standard is given for any article or material to be used in the Contract the relevant Specification of the British Standards Institution or other relevant Standard shall apply unless otherwise stated. The latest version of the standards referred to shall be used where applicable.
If the Contractor proposes to use a Standard Specification other than that specified, three copies of the proposed Standard Specification, in the English Language, shall be submitted to the Engineer not less than 28 days before approval of the Standard Specification is required.

Site Meetings

The Contractor shall be obliged to attend all meetings at the appointed time. The discussions of such meetings shall include but not be limited to the progress of work and problems having direct bearing on the immediate and long term activities (construction, procurement, transport, labour etc.).

The Engineer shall invite the Employer for such meetings.

Progress Photographs

The Contractor shall furnish the Engineer with coloured photographs (not less 8 cm x 120 cm size) of the work in progress throughout the Contract period. The photographs shall be taken at the start, during and at the completion of each major task of the work as directed by the Engineer. A brief description and date of each photograph shall be included.

The Contractor shall make a soft copy of all the photos. This copy will be retained on the site and on completion of the Works the negatives shall become the property of the Employer.

The Contractor shall supply cameras to the Engineer for taking of photographs.

Level Datum

The survey control points and bench marks shown on the drawings shall be handed over to the Contractor as basis for surveying and setting out of the Works. The Contractor shall be responsible for carrying out the field surveys for the performance of the Works.

Before using the control points and bench marks for setting out of the Works, the Contractor shall carry out a check survey thereon and satisfy himself as to their accuracy. The Employer shall bear no responsibility for the accuracy of any control point or bench mark.

The Contractor may establish additional temporary bench marks for his own convenience but each temporary bench mark shall be of a design and in a location approved by the Engineer and shall be accurate in relation to the bench marks established by the Engineer.

The Contractor shall protect the reference points and level bench marks and in the event of any damage he shall re-survey and re-establish the points and bench marks all to the satisfaction of the Engineer.

Setting Out

The Contractor shall appoint and employ the necessary qualified and experienced staff to set out the Works accurately. The Contractor shall establish and locate all lines and levels and be responsible for the correct location of all Works.


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Where directed by the Engineer, the Contractor shall take such levels and dimensions as may be required for the purposes of measurements prior to disturbance of the ground. These shall be agreed between the Contractor and the Engineer in writing before any of the surface is disturbed or covered up.

Construction and Checking of Work

The Contractor shall be solely responsible for and shall provide all labour, tools, lifting tackle and other equipment required for the construction and checking of the Works.

No operatives shall be allowed to execute any type of work, which is normally carried out by a skilled tradesman, unless the operative is thoroughly experienced and proficient in the trade concerned. Supervisors and operatives may be required to demonstrate their proficiency or produce certificate of competence to the satisfaction of the Engineer.

As each part of the work is carried out it shall be subject to the approval by the Engineer.

Supervision and Labour

The Contractor will be required to maintain a competent supervising Site Agent and staff on site throughout the construction period until completion of the Works, and thereafter as may be required during the period of maintenance. The Engineer shall give prior approval to the appointment of this supervising Site Agent and shall have authority to withdraw this approval at any time in accordance with the Conditions of Contract.

All staff and labour employed on the Works shall be employed in accordance with the local labour and employment laws and regulations.

Works Executed by the Employer or by other Contractors

The Employer reserves the right to execute, on the site, works not included under this Contract and to employ for this purpose either his own employees or other contractors whose contracts may be either a sub-contract under this Contract, or an entirely separate contract. The Contractor shall ensure that neither his own operations nor trespass by his employees shall interfere with the operations of the Employer, or his contractors employed on such works and the same obligations shall be imposed on the Employer or other contractors in respect of work being executed under this Contract.

Contractor’s Site Offices, Workshops, Storage and Working Areas

The Contractor shall at his own cost provide office and other temporary accommodation for his Site Personnel including sanitary facilities and canteen where necessary.

The Sanitary facilities shall be kept in a clean and orderly condition to the approval of the Engineer and public health authorities. Any employee found fouling the site shall be removed from Site immediately.

Site office and sanitary facilities shall be removed on completion of the work and all trenches shall be chemically treated and completely back-filled to the satisfaction of the Engineer.
The Contractor shall be deemed to have included for the costs thereof in his Tender.

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**Definition and Use of the Site**

**Definition of the Site**

The Site shall include all those areas of land which, being public or private:

(a) Are being provided by the Employer for the purpose of constructing the permanent works.

(b) Are being provided by the Employer or leased by the Contractor for Temporary Works, including camps, offices and stores.

(c) Are acquired, leased, or operated by the Contractor as borrow pits or spoil tips for the Permanent Works, including all access roads.

**Use of the Site**

The lands and other places outside the Site which are the property of or under the control of the Employer shall not be used except with the approval of the Engineer.

The Contractor shall at any time remove any vehicle or vessel or any other obstruction under his control that may be required to be removed by the Engineer for any purpose. The Contractor shall move such obstruction promptly on instruction being given.

The Contractor shall maintain access for the inspection, operation and maintenance of any of the Employer's plant or works which lies within the Site or elsewhere.

The Contractor shall not use any portion of the Site for any purpose not connected with the Works unless the written permission of the Engineer has been obtained.

Except with the written permission of the Employer, to be given when necessary for the execution of the Works, the Contractor's employees will not be permitted to enter any of the Employer's buildings or lands or sites under the control of other contractors or the Engineer. The Contractor shall warn his employees that any person found within such buildings or sites without authority is liable to be removed from the Works in accordance with the Conditions of Contract.

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**Possession of the Site**

The Contractor shall restrict his activities to those areas of the Site adjacent to the works being executed and shall avoid any encroachment upon lands outside the areas for which possession has been given. Any trespass or damage or any claim arising from such encroachment shall be the Contractor's sole responsibility and he shall hold the Employer indemnified against all claims arising from such trespass or damage.

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**Interference with the Works**

The Contractor shall not interfere in any way with any existing works, whether the property of the Employer or of a third party, whether or not the position of such works is indicated to the Contractor by the Engineer,
except where such interference is specifically described as part of the Works, either in the Contract or in an instruction from the Engineer.

Material for the Works

All material shall comply with appropriate Standard Specifications unless otherwise required hereinafter.

The Contractor shall, before placing any order of materials, manufactured articles or machinery for incorporation in the Works, submit for the approval of the Engineer the names of the suppliers from whom he proposes to obtain such materials, manufactured articles or machinery, together with a list of the same, giving the origin, quality, weight, strength, description and other relevant details. No materials, manufactured articles or machinery shall be ordered or obtained from any suppliers which the Engineer has not approved in writing.

All materials shall be delivered to the Site a sufficient period of time before they are required for use in the Works, to enable the Engineer to take such samples as he may wish for testing and approval.

Notwithstanding the fact that approval has been given to the source of supply, the Engineer may forbid the use of any materials if, upon delivery, they are found to be defective, or he considers them unsuitable for incorporation in the Works. Such rejected materials shall be removed from the site forthwith.

The Contractor may propose alternative materials of equivalent quality to those specified, and subject to the approval, such materials may be used in the Works.

The Contractor shall have no claim against the Employer in respect of any financial loss which he may suffer as a result of the rejection of any such materials, and he shall also bear the cost of removing them from the Site.

The Engineer shall have the right to inspect materials and plant for the permanent works during the course of manufacture. The Contractor shall arrange for the right of access to manufacturing premises for the Engineer and his staff during normal working hours. The Engineer shall be given sufficient notice by the Contractor to allow him to observe the testing of any materials for the works at the place of manufacture. The Engineer shall also be given the opportunity to inspect any material or plant in their completed state prior to packing for transport to the site.

If requested by the Engineer, the Contractor shall provide to the Engineer copies of orders for the supply of goods or materials required in connection with the works.

Rejected Materials and Defective Work

Materials or work which, in the opinion of the Engineer, do not comply with the Specification, shall be classified as rejected materials or defective work, and shall be cut out and removed from the Works and replaced as directed by the Engineer.

Existing Works and Services

The Contractor shall acquaint himself with the positions of all existing works and services including water mains, stormwater drains, cables, and service poles before any excavation are commenced.

The Contractor will be held responsible for any damage, however caused, in the course of the execution of the Works, to such existing works and services.

Such existing works and services, where exposed by the execution of the works, shall be properly shored, hung-up and supported to the satisfaction of the Engineer and of the authority concerned.

Poles supporting cables and the like adjacent to the Works shall be kept securely in place until the Works are completed and shall then be made as safe and permanent as before.

Notwithstanding the foregoing requirements and without lessening the Contractor's responsibility, the Contractor shall inform the Engineer immediately any existing works have been exposed and shall comply with any requirements of the authority concerned.

Only when and as directed by the Engineer shall the position of existing works or services be changed by the Contractor to meet the requirements of the proposed work.

The Contractor shall make adequate provision so that when carrying out his work, no interference, damage or pollution is caused to roads and footpaths, or to any mains, drains, and the like or other parts of the Works. Wherever loads have to be carried over ground in which pipes, valves, culverts, and the like are buried, the Contractor shall take all precautions including where necessary, the provision and use of sleepered roads, light gauge railways or other means to prevent damage occurring to such underground works. The Contractor shall not store any plant or materials or spoil heaps over existing water mains, or in such positions that interference with access to the mains, control gates and the like, is created. Approval by the Engineer to the means of protection employed shall not relieve the Contractor of any responsibility in respect of damage occasioned by his operations.

The laying of pipework, ducts, drains, and the like shall be arranged so as to cause as little interference as possible with the smooth operation of existing works.

When breaking out and making good existing structures, the Contractor shall disturb the existing structures as little as possible. All structures shall be made good with materials similar to those used in the existing works, or such materials which are considered by the Engineer to be of similar appearance and suitable in all other respects.

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**Existing Access**

Existing access to lands, property and all other places shall be maintained by the Contractor during the continuance of the Works to the Engineer's satisfaction.

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**Liaison with Police and other Officials**

The Contractor shall keep in close contact with the police and other officials in the areas concerned regarding their requirements for the control of workmen, movement of traffic, or other matters and shall provide all assistance and facilities which may be required by such officials in the execution of their duties.

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**Water and Power for Use on the Works**

The Contractor shall be solely responsible for the location, procurement and maintenance of a water supply adequate in quality and quantity to meet his obligations under the Contract.

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The Contractor shall be solely responsible for the location and continuity of the supply of water for use on the Works. Supplies may be derived from rivers and streams, but shall in all cases be to the Engineer's approval, and the abstraction of water from any sources shall not interfere with any permanent water supply and be to the requirements and permitted by Water Resources Management Authority (WRMA). The Contractor shall be solely responsible for the transporting of water from its source to the point at which it is required for construction purposes, and in such quantities and quality as to enable the Works to proceed without hinderance due to the shortage of adequate water supplies.

The Contractor shall make his own arrangements for power supplies and shall be solely responsible for the location, procurement and maintenance of a power supply, adequate to meet his obligations under the Contract.

The Contractor shall make his own arrangements for the supply of adequate safe drinking water, electricity and other services to the Permanent Works, Temporary Works and plant and shall provide and maintain all pipes, cables and fittings which may be necessary to carry such services to his operations.

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**Employer as a Supplier of Water and Power**

The position of the Employer or his Agent as a supplier of water or power shall be identical with that of other suppliers, and quite separate from his position as Employer under the Contract. As in the case of a supplier, a failure on the part of the Employer or his Agent to supply water or power will not relieve the Contractor of any of his obligations under the Contract, nor, in respect of any such failure, shall the Contractor have any claim under the Contract against the Employer.

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**Inspection by Engineer during Period of Maintenance**

The Engineer will give the Contractor due notice of his intention to carry out any inspection during the period of maintenance. The Contractor shall, upon receipt of such notice, arrange for responsible representatives to be present at the times and dates named by the Engineer. This representative shall render all necessary assistance and shall take note of all matters and things to which his attention is directed by the Engineer.

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**Site Offices for the Engineer**

The Contractor shall supply, erect and maintain offices and accommodations for the sole use of the Engineer and his staff for the duration of the Contract in a position to be designated by the Engineer.

The offices shall be soundly constructed of approved materials upon concrete bases, and shall be fully weatherproof. The exterior and interior faces of walls and ceilings shall be given two coats of emulsion paint of an approved colour or other approved finish. The offices shall be made dust, insect and vermin proof as far as possible.

The floor areas of the offices shall be as detailed in Appendix A to this Specification. Each room shall have a suitable lockable door and windows. The rooms shall either open onto a common internal passageway or onto a concrete floored covered walkway. Separate washing and toilet facilities shall be provided connected to a mains water supply and a suitable septic tank or sewage disposal system.

The Contractor shall arrange, provide and pay, all charges in connection with water, electricity and telephone supplies to the offices.
Each room shall be wired for electric light, power points, all to approved standards. The Contractor shall be responsible for a continuous supply of potable water, sufficient 240 volt electricity for the office and waterborne sanitation facilities to the office.

The Contractor shall provide and install furniture and equipment as detailed in Appendix B to this Specification, which shall revert to the Employer at the end of the Contract period.

The Contractor shall arrange for all offices and toilets to be cleaned each day and shall provide clean towels daily and an adequate supply of soap and toilet paper. The offices and contents shall be insured by the Contractor against fire, burglary, lacency and other risks ordinarily insured by a householder.

Hard standing for four vehicles shall be provided adjacent to the offices. This area shall be covered with corrugated iron sheets of gauge 28.

At the end of the Contract Period the offices shall be removed and the site reinstated to the satisfaction of the Engineer.

Time for Erection of Site Offices for the Engineer

The Contractor shall, within two weeks of the award of the contract submit to the Engineer his layouts and construction proposals for the offices of the Engineer and his staff together with details of furniture and equipment to be provided in accordance with Appendix B of this Specification.

The Engineer will then either approve or require modifications to be made to the Contractor's proposals and will instruct the Contractor to proceed with the erection of the offices and with the provisions of furniture and equipment. The Contractor shall then provide the offices, furniture and equipment within six weeks of the date on which the Engineer instructs the Contractor to proceed with such provision.

The Contractor shall bear all expenses incurred by the Employer due to the failure of the Contractor to complete and hand over to the Engineer the offices; furniture and equipment required within the six weeks or such other period as may be stipulated.

Accommodation for the Engineer

The contractor will construct houses for the accommodation of the Engineer and his staff at a site that will be provided by the Employer. The Contractor will be required to propose in his tender, the bills of quantities and the rates for the work required for detailed design and construction of the houses. This shall be a provisional item in the Contract and shall be reimbursed to the Contractor using the proposed rates.

The Contractor shall arrange for continuous supply of potable water, sufficient 240 volt electricity supply, and telephone to all the Engineer’s staff houses. Each senior Engineer house shall be provided with a house helper, full time 24 hours security and telephone connection.

Facilities to the Engineer’s accommodation shall be provided under a provisional sum item and shall include but not be limited to the provision of hard and soft furnishings, payment for utilities and service staff as necessary, all at the discretion of the Engineer. A schedule of the furniture’s and fittings to be purchase for the Engineer’s accommodation is attached as Appendix B.

Engineer’s accommodations shall be ready for use within ninety days of the date of the Notice to commence. During the period that the houses are not ready the Contractor will provide alternative accommodations and transport all to the approval of the Engineer at no extra cost.
Survey Instruments and Chainmen for the Engineer

The Contractor shall provide and maintain in first class working order, for the sole use of the Engineer and his staff for the duration of the Contract, the following minimum survey instruments complete with all accessories, tapes, poles, staves, stagings, moulds, templates, profiles, and requisites necessary for checking and setting out, and measurement of the Works. The equipment shall revert to the Client at the end of the Contract Period.

The survey equipment shall include those shown in Table 1.13 or similar approved as a minimum:

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTS 225 TOPCON Total station</td>
<td>1</td>
</tr>
<tr>
<td>TOPCON On board batteries</td>
<td>2</td>
</tr>
<tr>
<td>TOPCON Battery charger</td>
<td>1</td>
</tr>
<tr>
<td>Single Prism and target</td>
<td>4</td>
</tr>
<tr>
<td>Auto level</td>
<td>1</td>
</tr>
<tr>
<td>Plumbing pole 4.6 m length</td>
<td>6</td>
</tr>
<tr>
<td>Wooden Tripod</td>
<td>4</td>
</tr>
<tr>
<td>Plumbing pole tripod with bubble</td>
<td>4</td>
</tr>
<tr>
<td>Interface cable to computer</td>
<td>1</td>
</tr>
<tr>
<td>External battery</td>
<td>1</td>
</tr>
<tr>
<td>External battery charger</td>
<td>1</td>
</tr>
<tr>
<td>Ranging rods</td>
<td>8</td>
</tr>
<tr>
<td>5 m steel tape</td>
<td>7</td>
</tr>
<tr>
<td>50 m glass fibre tape</td>
<td>2</td>
</tr>
<tr>
<td>Scale rule</td>
<td>6</td>
</tr>
<tr>
<td>Drawing table</td>
<td>1</td>
</tr>
<tr>
<td>Digital Camera</td>
<td>4</td>
</tr>
<tr>
<td>Dust proof mask</td>
<td>30</td>
</tr>
<tr>
<td>Rock hammer</td>
<td>3</td>
</tr>
<tr>
<td>Schmidt hammer</td>
<td>3</td>
</tr>
<tr>
<td>Helmet</td>
<td>15</td>
</tr>
<tr>
<td>Life jackets</td>
<td>10</td>
</tr>
</tbody>
</table>

Engineer’s Material Laboratory

The Contractor shall provide, equip and maintain, including power supply, for the Engineer's use a testing laboratory with necessary testing equipment to execute Works specified in the Contract. The laboratory and the equipment shall be removed and the site reinstated by the Contractor at the end of the Contract. The laboratory and equipment shall revert to the Contractor at the completion of the Contract.

The Contractor shall provide all necessary labour required by the Engineer, for the efficient running of the laboratory for the purpose of controlling the quality of materials used in the Works. The management of the laboratory shall be by the Engineer.

The existence of the laboratory shall in no way relieve the Contractor of the responsibility for carrying out his own tests in order to maintain the degree of control of quality hereinafter specified.

The Contractor is required to keep at the project site, the following minimum equipment at all times during the Contract period:

(a) Two (2) complete set of sieves of 200 mm or 300 mm diameter including cover, pan and brush;
(b) Two (2) pan type weighing scale complete with weights, to weigh up to ten kilograms (10kg) with sensitivity one gramme (1 g);
(c) Two (2) galvanized steel slump test cone apparatus complete with standard tamping rod and base plate;
(d) Six (6) steel 15cm cube moulds, complete with two (2) tamping rods, base plates and trowels;
(e) One (1) chemical balance to weigh up to two hundred and fifty grammes (250 g) with weight box and sensitivity of one tenth of a gramme (0.1 g);
(f) Fifty kilograms (50 kg) of clean, air-dried uniformly graded sand passing a 1.2 mm sieve and retained on a 600 micron sieve;
(g) Two (2) sand-cone apparatus comprising glass jars, metal funnel, base plate and excavating tools for determination of field density;
(h) Three (3) glass graduated cylinders of one litre (1 l) capacity each;
(i) Three (3) thermometers with a range of zero (0°C) up to one hundred degrees Celsius (100°C);
(j) Twelve (12) moisture cans with lid, 100 mm diameter and 25 mm deep for moisture content determination of soil samples.
(k) Six (6) sample drying trays 0.5 x 0.5 x 0.03 m;
(l) Four (4) sample drying trays 1.0 x 1.0 x 0.05 m;
(m) Six (6) sample drying trays 0.25 x 0.25 x 0.03 m;
(n) One (1) sample drying oven, 100 litre capacity;
(o) Four (4) standard compaction moulds with base plates;
(p) Four (4) standard compaction rammers;
(q) Two (2) pairs of Atterberg limit apparatus;
(r) Four (4) stainless steel flexible spatulas;
s) Concrete Cube Crushing Machine.

All mechanical equipments to be used for measurement or weighing shall be calibrated as required and calibration certification issued by the calibrating body.

Transport for the Engineer

The Contractor shall provide and maintain in first class working order, vehicles for the sole use of the Engineer and his staff for the duration of the Contract as detailed below:

Four wheel drive Toyota Prado, Station Wagon of not less than 3000 cc capacity or similar approved - 2 No

Four wheel drive Toyota Hi-lux Double cabin vehicle of not less than 2500 cc capacity or similar approved - 3 No

The vehicles shall be handed over to the Engineer new from the suppliers and shall be comprehensively insured for all drivers and passengers. The Contractor shall be responsible for the provision of fuel and lubricants, and for maintaining the vehicles in a fully road-worthy and serviceable condition. The vehicles shall be provided within 28 days of the date of the Notice to commence. The Contractor shall provide similar rented vehicles to the approval of the Engineer, at no extra cost to the Contract within two weeks of the date of the Letter of Acceptance until such time as the Engineer takes delivery of the new vehicles to be supplied for his site staff under the Contract.

The vehicles shall, as far as possible, be maintained on a regular basis and the Contractor shall provide a replacement vehicle of similar standard wherever a vehicle supplied under this Clause is not available for use because of un-serviceability or because of regular maintenance taking more than four hours a week.

The Contractor shall provide one workshop manual for the type of vehicles supplied. The Contractor shall provide the Engineer with the vehicle specifications for confirmation/approval prior to the placing of an order.

The Contractor shall provide the full time services of a driver for each vehicle. The drivers supplied shall be experienced in driving the type of vehicle supplied, and shall speak and understand the English language. Should the Engineer consider a driver's standard of driving to be inadequate for any reason, the Contractor shall replace the driver with another. Any senior member of the Engineer's staff holding a valid driving licence shall be entitled to drive the vehicles supplied under this Contract.

The vehicles shall revert to the Employer at the end of the Contract.

Sign Boards

Before the erection of any sign boards or posters by the Contractor, the Contractor shall obtain the approval of the Employer and the Engineer to the size, location and wording of such sign boards or posters.

Unless otherwise agreed, the signboard shall be in three sections. Section One shall contain:

Name of Financing Governments
In white lettering on a blue background
The Second section shall bear the words:

Names of the Program and Project
In white lettering on a blue background
The Third section shall bear the words:

Name of the Financier
In white lettering on a blue background
The Fourth section shall bear the words:

Name of the Employer
In white lettering on a blue background
The Fifth section shall bear the words:

Name of the Implementing Agency
In white lettering on a blue background
The Sixth section shall bear the words:

Name of the Executing Agency
In white lettering on a blue background
The Seventh section (Contractors Board) shall bear the words:
Name of the Contractor

In white lettering on a blue background

The Eighth section shall bear the words:

Name of the Supervising Consultancy

In white lettering on a blue background

Further boards may be added with the names of sub-contractors.

Lettering on these boards shall be as directed by the Engineer

Further boards may be added with the names of sub-contractors.

Tracked Plant

The Contractor's tracked plant may not be run on any public or private road without the written permission of the owner or authority concerned.

Fuel Supplies

The Contractor shall arrange for obtaining, storing and distributing all fuel oils required for the completion of the Works. The storage of fuel on site shall comply with the Petroleum Act and Factories Act applicable in Kenya. Copies of this can be purchased by the Contractor at the Government Printers.

Telephone and Communications

The Contractor shall obtain suitable means of communications during the course of the Contract. The use of radio communications may be permitted but the Contractor shall be responsible for obtaining all the necessary permission and licences.

Preservation of Trees

No tree shall be removed without prior written permission of the Engineer who will limit the removal of trees to the minimum necessary to accommodate the Permanent Works.

If trees are removed or damaged by the Contractor or his employees, without approval, then the Contractor shall replace such trees.

Replacement of trees shall not be with seedlings less than two years of age, obtained from a reputable nursery and of a species approved by the Engineer. The Contractor shall plant, water and ensure that the replacement trees are properly established, all at his own costs.

Protection from Water

The Contractor shall keep the whole of the Works free from water and shall be deemed to have included in his Contract Sum all costs for pumping, shoring, temporary drains, sumps and other measures and provisions necessary for such purposes and for clearing away and making good to the satisfaction of the Engineer any damage caused thereby.

Protection against Fires

The Contractor is advised that, at all times, it is necessary to guard against fires starting within the Site or in the environs thereof, particularly as the result of the Works or from the actions of his employees. The Contractor shall have available, at all times, a trained fire-fighting team provided with adequate fire-fighting equipment and shall deal with all fires on the Site howsoever caused.

The Contractor shall be responsible for maintaining qualified fire fighting crew on the Site at all times as well as maintaining an efficient fire alarm system. The Contractor shall also submit a fire prevention and fire fighting program for the Engineer’s approval.

The Contractor shall provide suitable and adequate fire fighting equipment, to the satisfaction of the Engineer, for ready use at all the times in all the Engineer’s site establishment including Contractor’s residential quarters, labour camps and ancillary buildings. These shall be maintained until the completion of the construction and handing over of the works to the Employer.

The Contractor shall comply with laws and regulations such as Occupational Health and Safety Act 2007 legislation and any other legislations and regulations regarding fires and with respect to the prevention of fires. No fire may be lit in the dry season without written permission from the Engineer and/ or the relevant Authority.

Safety Precautions

The Contractor shall adhere to the current legislative requirements from Factories Inspectorate, Ministry of Labour, in respect of the appointment of Safety Supervisors on Building and Works of Engineering Construction. In accordance with these requirements, the Contractor shall appoint a Safety Supervisor who shall be qualified in safety and familiar with the works being performed. The Safety Officer shall ensure that adequate measures and rules for the protection of health and safeguarding against accidents are enforced.

The Contractor shall take all necessary precautions against risks of loss of life or of injury to any person employed on the Works or to employees of the Employer and to the Engineer or to visitors or to persons having good and sufficient reasons to be about the Works, and to this end he shall properly safeguard the Works to the satisfaction of the Engineer and in accordance with the Occupational Health and Safety Act 2007 legislation and any other legislations that govern safety at construction sites in Kenya.

The Contractor shall at all times comply with any accident prevention regulations and any safety regulations peculiar to the various trades employed on the Works, and any safety regulations published by the Government.

The Contractor shall report promptly to the Engineer all accidents involving the death of or serious injury to any person on the Site or resulting from the Contractor’s operations.
The Contractor shall, at his own expense, educate all his employees on safety precautions based on good practice on site. This shall be done in both English and Kiswahili languages. Safety instructions shall deal with all safety measures including but not be limited to the following; protective clothing, helmets and footwear, use of lifting equipment, precautions against electrical shock, welding, routine procedures in case of accidents, fires, etc., watchmen, warning notices and barriers, use of drilling equipment and dust suppression and use and storage of explosive.

Explosives and Fuels

The Contractor shall make arrangements to transport, store and handle explosives and fuels in a safe manner for protecting the public in accordance with the laws and security regulations in force in the Republic of Kenya. In this regard, he shall submit a program to the Engineer for approval for the safe handling and storage of explosives and fuels. The programme shall be accompanied by material data sheets for each of the explosives and fuels. When approved, the Contractor shall issue a copy to each of his personnel involved with the handling of explosives and fuels.

The Contractor shall obtain all necessary licenses and shall pay all fees and charges in respect of the same as may be necessary for the purpose of moving explosives and fuels from place to place and storing the same, and shall make all applications and obtain approvals from the relevant authorities of the Government of Kenya.

The Contractor shall construct his explosives magazines at locations and in a manner complying with the relevant regulations of Kenya and approved by the Engineer. Detonators and fuse shall be stored in a separate magazine away from explosives. In no case shall they be transported in the same vehicle with explosives.

The Contractor shall provide adequate protective facilities to safely store and to prevent the loss or theft of explosives. Overnight storage of explosives and detonators outside of the magazines will not be permitted. Magazines shall be securely locked when not in use.

The Contractor shall maintain an inventory record of storage and withdrawal of all explosives including detonators. This record shall be available to the Engineer, and the Engineer shall be promptly notified of any loss or theft of explosives.

The Contractor shall supply and install sirens and loudspeakers systems, so that adequate warning may be given to all persons who may be endangered when explosives charges are to be fired. The Contractor shall ensure, prior to discharging explosives, that the area to be blasted is clear of all workmen, residents, pedestrians etc. in addition he shall post flagmen on each of the roads entering the said area so as to stop and prevent any traffic from entering into the area until “all clear” notification is given.

During thunderstorms and other electrical disturbances, no charging and firing will be permitted.

Above Ground Fuel Storage Tanks

The fuel storage tank shall comply with BS 21, 1387, 799, 2594 and 5410 and shall have internal working pressure up to and including 0.4 bar, measured at the top of the tank, and a maximum internal vacuum of 10 mbar. Unless otherwise shown on the drawings, the tank shall have a manhole whose centre shall be 450 mm from one end. Filling point shall be fitted to the highest point in the tank shell and vent and dip point shall be fitted preferably at the centre of the manhole lid. The Contractor shall supply the dip stick.
The drain point shall be fitted at the lowest point in the tank and flush with the inside of the shell. This shall be at a minimum of 150 mm from the ground level. The draw off shall be welded near the base of the tank on the vertical centre-line and at the opposite end to the drain.

The tank shall be suspended from the ground by saddle supports and the bond between the tank and the supports shall be broken by application of bituminous paint on the tank and the saddles. The tank shall be fitted with lifting tugs /hooks of sufficient strength at locations shown on the drawings. The location of the tank shall be firm ground with reinforced concrete slab with a provision of catch pits and sumps of sufficient capacities and to the satisfaction of the Engineer. A bund wall shall be provided round the hard standing concrete slab.

The tank shall be earthed in accordance with BS 7430 AND 6651. The earth system shall terminate with copper earth rod in earth test pit.

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**Watching, Fencing and Lighting**

The Contractor shall employ competent watchmen to guard the Works both by day and night.

Any excavations, material dumps, spoil dumps or other obstructions likely to cause injury to any person or thing shall be suitably fenced off and at night marked by red warning lights.

Fences shall consist of at least three 15 millimetres diameter hemp ropes or 4mm diameter wires, or more if required, stretched tightly between poles, and standards securely planted in solid ground, well clear of the excavation. The poles, and standards shall not be more than 15 metres apart, and where circumstances require, they shall be placed closer. Ropes or wires shall be stretched tight approximately 0.4 metres, 0.8 metres and 1.2 metres respectively above the ground. Banks of spoil may be accepted by the Engineer in lieu of fencing if of suitable height and form.

Fences and spoil banks shall be clearly marked at the ends, all corners, and along the length at intervals of not more than 15 metres by means of white limewashed boards, discs, stones or oil drums during the daytime and by red lamps burning at night. Markers shall be freshly limewashed at regular intervals to ensure that they are white and clean.

If a road is closed, or partly closed to traffic, temporary traffic and barricades shall be erected by the Contractor to the satisfaction of the Engineer and the police, or other relevant authority, to give proper warning to traffic and the public. Lettering on road signs shall be black on a yellow background and shall incorporate reflective material. The signs shall be adequately illuminated at night.

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**Soil Conservation**

All precautions shall be taken by the Contractor to prevent the erosion of soil from any lands used or occupied by the Contractor for the purpose of the execution of the Temporary Works.

If in the opinion of the Engineer, the Contractor’s operations in areas other than the permanent works caused soil erosion, the Contractor shall undertake soil conservation measures in these areas as directed by the Engineer. The details of the proposed soil conservation measures shall be submitted by the Contractor for the Engineer's approval prior to the execution of the said works.

All soil conservation measures shall be carried out at the earliest possible time, as approved by the Engineer, to ensure that the required protection is established most effectively during the progress of Works.

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No separate payment will be made for the soil conservation measures and such costs shall be deemed to be included in the respective unit rates and the Contract Sum.

**Dust Abatement**

During the performance of the work the Contractor shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance resulting from his operations. Measures shall include, but not be limited, to installation of dust suppression units on his rock drilling equipment, watering down of excavated material during loading operations, and use of water tankers to sprinkle access roads, disposal areas, etc.

The Contractor shall be held liable for any damage to crops, cultivated fields and dwellings of persons in the neighbourhood of the Works resulting from his operations.

In addition, the Contractor shall provide his employees, visitors or any other individual on site with personal protective equipment against dust at all times so that they are not exposed to the dust hazard.

No separate payment will be made for the dust abatement measures and the costs thereof shall be deemed to be included in the respective unit rates and the Contract Sum.

**Noise Control**

All work shall be carried out without unreasonable noise. Compressors used on site shall be silenced either by using only full silenced models or fitted with effective exhaust silencers and properly lined and scaled acoustic covers all to the design of the manufacturers of the compressor or by the use of effective acoustic screens to enclose the noise source. Pneumatic percussion tools used on Site shall be fitted with silencers of a type recommended by the manufacturers of the tools. Compressors, silencers or other equipment shall be maintained in good and efficient working order.

Additionally, where noise from the equipment cannot be minimised using silencers and other equipment related measures, the Contractor shall at all times provide the correct Personal protective equipment for the employees, visitors and any other person on site working within the noise range.

No separate payment will be made for noise suppression measures and the costs thereof shall be included in the unit rates and the Contract Sum.

**Sanitation**

The Contractor shall provide adequate sanitation and refuse collection and disposal facilities complying with state laws and local by-laws for all houses, offices, workshops, and the like, erected on the site, all to the satisfaction of the Engineer.

The toilet facilities provided at the site by the Contractor shall be made available, free of charge, to the employees of the Contractor and any of his subcontractors.

The Contractor shall warn his employees and sub-contractors that any employee found fouling the site shall be removed from the site immediately in accordance with the Conditions of Contract.

The Contractor shall remove all rubbish and to this end shall provide adequate number of covered garbage bins/containers placed at convenient points around the site establishments. The Contractor shall institute and maintain a regular garbage collection and disposal system. Garbage shall be disposed of by burning, by burial or by other means approved by the Engineer.

No separate payment will be made for such sanitary arrangements and all such costs will be deemed to be included in the unit rates and Contract Sum.

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**First Aid and Medical Services**

The Contractor shall provide and maintain all equipment necessary to render first aid in case of accidents, snake bites or other emergencies according to Occupational Health and Safety Act 2007 legislations regarding workplace health and safety and any other relevant legislation. This equipment shall be kept in readiness at the sites of the works, at camps and wherever the Contractor's staff may regularly live and work. The Contractor shall ensure that there are persons available to all such places with knowledge of simple first aid procedures and able to administer snake bite treatment.

In addition, the Contractor shall provide at his own cost, training to the relevant employees on ways and means of preventing snake bites.

In general, the contractor shall be guided by the following,

- Where the number of workers exceeds 25 - provide a stretcher and a vehicle that can carry a person on a stretcher
- Where the number of workers exceeds 250 - provide first aid room with a qualified nurse to be on duty during all shifts.

Notwithstanding the minimum requirements prescribed above, the Contractor shall be responsible for the adequacy of all the arrangements made.

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**HIV/AIDS Awareness**

The Contractor shall implement an HIV/AIDS awareness programme for his Personnel.

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**Pollution**

During the execution of the Works, the Contractor shall ensure that no pollution of existing watercourses is allowed to take place as a result of his operations. The Contractor shall take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the republic or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

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**Maintenance of Irrigation Water Supplies**

The Contractor shall be responsible for maintaining perennial irrigation water supplies so that the supply may be used in any part of the command area at all times unless otherwise agreed in advance with the Irrigators’ Association and approved by the Engineer.
Restoration of Drains, Streams, Canals etc.

Subject to any requirement of the Works whereby a permanent change is to be effected, all drains, canals, pipes, channels, water-courses or streams temporarily cut through or disturbed by the excavation of the Works are to be restored so that the water flowing in them may continue to flow in as full and free manner as it did before the disturbance.

Site Clearance

On completion of the Works, the Contractor shall clear the site and remove all temporary buildings, equipment and debris. The Contractor shall level off and grade all areas used for haul roads and all building, store and workshop areas. The whole of the site shall be left in a clean and tidy condition.

Weather Records

The Contractor shall erect two rain gauges ("Nylex 600" or similar approved) and a double bulb, minimum/maximum thermometer (0.1°C accuracy) at sites agreed with the Engineer. The Contractor shall be responsible for the daily measurement of rainfall and minimum and maximum temperature to be taken at 8:00am each day.

Units and Abbreviations

The units of measurement used in these Contract Documents are metric.

The following abbreviations have been used for units and for other words or phrases as indicated.

Abbreviations in the Contract Documents shall have the following meanings:

- mm: millimetre
- m: meter
- km: kilometre
- sq.m, m²: square metre
- ha: hectare
- cu m, m³: cubic metre
- sec, s: second
- hr: hour
- min: minute
- wk: week
- l: litre
- gm: gram
- kg: kilogram
- t: tonne
- No: Number
- nr: Number (in bill of quantities)
- dia: diameter
- max: maximum
- min: minimum
AD     above datum (levels in metres)
ch     chainage (distance in metres)
eo     extra over
ex     exceeding
ne     not exceeding
PQ     Provisional Quantity
PS     Provisional Sum
Do     Ditto
fob    free on board
cif    cost, insurance, freight
wt     weight
%      percent
mh     manhole
ic     inspection chamber
HYS    high yield steel
PCC    precast concrete
uPVC   uplasticised polyvinylchloride
GMS    galvanised mild steel
DI     ductile iron
SV     sluice valve
ISO    International Standards Organisation
KS     Kenyan Standard
BS     British Standard
KES.   Kenya Shillings

**Tender Document:** Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes, NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
EARTHWORKS

Site Clearance and Stripping

General clearance is defined as the clearing, grubbing, removal and disposal of all vegetation, grass, debris, bushes, dense bush, trees, hedges, undergrowth, stumps, roots, shrubs plants and backfilling of holes left by the removal of stumps and roots.

The widths and length over which site clearance is to be carried out shall be instructed by the Engineer. Site clearance over the area of quarries, borrow pits, stockpiles and spoil tips shall be carried out where instructed by the Engineer. The Engineer may give instructions that specific trees, stumps or objects shall not be removed during site clearance operation.

If termite moulds are excavated, the whole of the mould shall be removed.

Where the Engineer instructs that site clearance is required, the entire area shall be cleared and all materials thus cleared shall become the property of the Employer. Unless otherwise instructed, vegetation and perishable materials shall be disposed of by burning. Where material or debris cannot be burnt, it shall be carted to spoil areas, which spoil areas shall be provided in accordance with requirement of this Specification.

If the Contractor clears the Site in advance of the main Works such that the grass and other vegetation regrows prior to the main Works commencing at any particular location then any additional, or repeating of, site clearance required shall be at the Contractor’s expense.

When instructed by the Engineer, the Contractor shall demolish wholly or in part, remove and dispose of all buildings, foundations, structures, fences and any other obstructions which have not been designed to remain.

The Contractor shall carefully take down such buildings, structures; fences etc. and the components shall be dismantled, cleaned and stacked in separate heaps. All materials which, in the opinion of the Engineer, are not fit for re-use shall be removed from the site to spoil areas provided in accordance with the requirements of this Specification. All materials, which are re-usable, shall remain the property of the Employer and shall be preserved and protected by the Contractor until removed by the Employer or until the expiry of the Period of Maintenance.

All existing paths, fences, walls, hedges, trees, shrubs, lawn and other features which the Engineer instructs not to be removed or otherwise dealt with, shall be protected from the damage, and any damage which occurs due to the Contractor’s failure to take adequate precautions shall be repaired at the Contractor’s expense.

Site clearance shall be measured in square metre, calculated as the plan area instructed by the Engineer to be cleared. The rate for the site clearance shall include for the cost of complying with the requirements of Clauses 2.1, 2.13 and 2.14.

Stripping work shall basically consist of removal of top soil, grasses, vegetative material to a depth of 150 mm below ground level and its disposal to a stockpile. Stripping shall include for removal, stockpiling and for reinstatement or spreading as directed by the Engineer. Measurement and payment of this shall be in square metres, calculated as the plan area instructed by the Engineer.
Surface Levels

After the area of any section of the Works has been cleared and after trees have been felled, stumps removed and termite moulds excavated to the satisfaction of the Engineer, but before any other work is commenced, surface levels of the ground shall be taken. The levels shall be taken at spacings agreed with the Engineer. Levels shall similarly be taken on the surface of the ground after the removal of unsuitable overburden prior to placing fill and at the interface between natural ground, rock or artificial hard material layers. The levels shall be agreed with the Engineer. The Contractor shall prepare plans and sections which shall, when finally and mutually agreed, be signed by the Engineer and Contractor as truly representing the configurations of the areas in question at the commencement of excavation or fill construction.

Definition of Earthwork Materials

The following definitions of earthworks materials shall apply to this and other Clauses of the Specification in which reference is made to the defined materials:

(a) "Top soil" shall mean the top layer of soil that can support vegetation

(b) "Suitable material" shall comprise all material which arises from excavations within the Site and which is approved by the Engineer as acceptable for use in the Works

(c) "Unsuitable material" shall mean material other than suitable material and shall comprise:
   - Material from swamps, marshes and bogs
   - Logs, stumps and perishable materials
   - Material susceptible to spontaneous combustion
   - Clay of liquid limit exceeding ninety (90) and/or plasticity index exceeding sixty five (65)

(d) "Rock" or "hard material"

Rock or hard material shall be material which cannot be ripped to an average depth of greater than 300mm by a track type crawler tractor complying with the following:

- In good order complete with all equipment and accessories as supplied;
- Rated 300 BHP flywheel power or over;
- With an operating weight of not less than 37.2 tonnes;
- Equipped with a hydraulically operated single tine ripper compatible with the tractor used; and
- Operated by a qualified operator in accordance with the manufacturer's recommendations and to the satisfaction of the Engineer.

Where it is impractical to prove hard material by the above method then the quantity of hard material, if any, shall be determined by the Engineer.

Where excavation contains individual boulders of hard material greater than 0.3 m³ each in volume then such boulders shall be classified as hard material.

(d) "Soft material" material shall mean all material other than that defined as "rock" or "hard material".

Removal of Unsuitable Material

Where directed by the Engineer the Contractor shall remove unsuitable material to the depth as ordered or agreed with the Engineer and shall dispose of it in approved spoil tips.

Excavation General

Excavation shall be carried out with the allowances for working space given in the Method of Measurement to the Bill of Quantities, unless otherwise shown as lines, levels and profiles on the Drawings or to such other lines, levels and profiles as the Engineer may direct or approve in writing. The work shall be carried out by the Contractor in such a way as to avoid disturbance to the surrounding ground. Particular care shall be taken to maintain stability when excavating in close proximity to existing works.

The work shall be carried out in a careful manner to ensure that the exposed surfaces are as sound as the nature of the material permits and that no point shall protrude inside the lines shown on the Drawings except as otherwise specified or agreed by the Engineer. In soft excavation, which is to remain open permanently, exposed faces shall be formed accurately to the required slopes and profiles. Excavations in rock where the faces shall remain open permanently shall be trimmed so that no point protrudes within the required profile.

The Contractor shall examine all excavated faces regularly and shall remove all insecure materials resulting from any falls. Where instructed in writing by the Engineer, the Contractor shall wash down exposed surfaces of excavated rock for inspection.

The Contractor shall dispose of all material arising from excavations. If it is suitable and required for the Permanent Works it shall be placed directly in such Works or set aside for use as and when required in suitable approved dumps, otherwise it shall be removed to tips provided by the Contractor unless otherwise provided or directed by the Engineer.

The Contractor shall be responsible for keeping all excavations free from water from whatever cause arising and shall provide such pumping capacity and other measures as may be necessary for this purpose. The Contractor shall make good any damage that may result from his failure to keep the excavations free from water.

All excavation shall be carried out with care and the method and plant to be used in execution thereof shall be to the satisfaction of the Engineer. The Contractor shall be responsible for the safety and security of all excavations at all times during the execution of the contract and where necessary shall provide timbering, shoring or other measures required by the Engineer to prevent movement or loss of ground outside the boundaries, settlement of or damage to property, or injury to persons. The Contractor shall make good any damage to structures, services or other properties caused by such movement, loss of ground and settlement. The Contractor shall also take precautions to route his plant in such a manner as to minimise the likelihood of slips occurring due to vibration or surcharge from the working or movement of heavy machinery.

The Contractor will be permitted, subject to the approval of the Engineer, to adjust side slopes of excavations in soft materials which are to remain open temporarily in preference to shoring or strutting. However no payment shall be made for extra excavation volume as a result of these measures.

The Contractor shall notify the Engineer without delay of any permeable strata, fissures or unusual ground encountered during excavation.
Blasting

The Contractor shall not be permitted to use explosives for rock excavation without the approval of the Engineer. The Contractor shall only employ suitably qualified and experienced personnel to manage and supervise blasting operations. For each blasting operation, the Contractor shall submit to the Engineer for approval a statement detailing the type of explosives to be used, method of transport, storage, blasting procedures, safety precautions to be observed and the names and experience of the personnel who will supervise the work. Notwithstanding the Engineer’s approval, the Contractor will be responsible for the blasting operations and shall accept full and absolute liability for any claims resulting either directly or indirectly from the use of explosives on the Site.

The blasting operations shall comply in every respect with the regulations and laws covering the use of explosives and the Contractor shall be responsible for obtaining all necessary permits.

Excavation Beyond Line or Level

If from any cause whatsoever excavations are carried out beyond their true line and level other than on the instructions of the Engineer, the Contractor shall make good to the required line and level with the appropriate grade of filling to be contained in the true excavation, or with concrete or other approved material in such a manner as the Engineer may direct. This shall be at the Contractor’s expense.

Approval of Excavation

When excavations have been taken out accurately to the profiles or dimensions required for the work the Contractor shall inform the Engineer who shall carry out an inspection of the excavation. If, after his inspection the Engineer requires additional excavation to be carried out, the Contractor shall do so to such new profiles or dimensions as the Engineer may direct.

Excavation for Structures

Open excavation to form a foundation for a structure shall be carried out to the lines necessary to permit the proper construction of the structure to the approval of the Engineer.

Where a structure is to be founded on soft ground, the excavation shall be taken down until the required formation is exposed and prepared to the approval of the Engineer. Where concrete has to be placed on a soft foundation, the Engineer may direct that a blinding layer of lean concrete be placed beneath the structural concrete immediately after completion and approval of the excavation, or require the Contractor to remove the last 100 mm of excavation immediately prior to placing the concrete. If foundation conditions are very soft the Engineer may instruct that additional material be excavated and replaced with compacted gravel or hardcore.
Where a structure is required to be founded on rock but is not required to penetrate into it, all soft overburden shall be removed and the surface of the rock cleared of any loose material by barring and wedging. Where the foundation is required to penetrate into the rock, excavation of the rock may be carried out by blasting but in such a manner as to prevent the shattering of the rock which is to remain. The Engineer may direct that the last 300 mm of rock be left and be removed by barring and wedging or by the use of approved pneumatic tools so that the exposed surface is sound.

The Contractor shall report to the Engineer whenever excavations are ready to receive concrete. No concrete shall be placed in the foundations until the Contractor has obtained the Engineer’s agreement that a secure foundation has been reached and that the excavation has been carried out to the lines and levels required.

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**Excavation for Fill Foundation**

Foundations for embankments shall be excavated to the depths or to the soil or rock grade indicated on the Drawings or described in the Specification. The suitability of each part of the foundation for placing fill thereon shall be determined by the Engineer. No fill shall be placed before acceptance of the foundation by the Engineer and recording of the geology.

Where specified in the Drawings or Specification or directed by the Engineer, seams and other defects below the general level of the foundations shall be excavated and filled or covered with materials including mortar and concrete to the satisfaction of the Engineer before fill is placed thereon.

Where embankments are to be constructed on sloping ground, and where shown on the Drawings, benches shall be excavated in the foundations to the dimensions shown on the Drawings.

Except where specifically permitted by the Engineer all foundations for fill shall be kept free of water when placing fill thereon.

Earth foundations shall have the top 150 mm sufficiently moistened and, if necessary, harrowed or scarified and compacted to at least ninety five per cent (95%) of the maximum dry density as determined by the AASHTO T99. Material too wet to be so compacted shall, as directed by the Engineer, be allowed to dry, harrowed or scarified to reduce the moisture content to the required amount and then be re-compacted.

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**Trench Excavation**

Trench excavation shall be performed by the use of hand tools and approved mechanical equipment, in such manner as to minimise disturbance of the sides and bottom of the excavation.

Trenches for pipes shall be excavated to a sufficient depth to enable the pipe and the specified joint, bedding, haunching and surround to be accommodated. Unless otherwise stated, the width of the trench shall be equal to the nominal diameter of the pipe plus 600 mm.

The Contractor shall fill any over excavation beneath the pipe or bedding at his own cost with well rammed selected general excavation material as per requirement of this Specification. The Contractor shall dispose of surplus excavated material not required for backfill to spoil tips.

The sides of trenches shall be adequately supported at all times. Alternatively where the Contractor has to excavate the trenches in open cut the Contractor shall ensure that the side slopes of the excavation are sufficient for stability.
Where rock or boulders are present in the sides or base of a trench in which a pipe is to be installed, the trench shall be trimmed so that when the pipeline is laid, no projection of rock comes within 200 mm of the outside of the pipe at any point. The over excavated portion shall be backfilled as set out in this Specification with approved granular material at the Contractor’s expense.

The Contractor shall be entirely responsible for the sufficiency of all temporary supports and side slopes to the excavations. The excavation shall be carried out in such a way as to maintain the stability of all roads and other adjacent structures or works.

Channel Excavation

The excavation of all channels shall be executed in such a manner as to ensure that the stability of side slopes is not endangered. Should slips or undercutting occur for reasons attributable to the Contractor's negligence or method of working, the Engineer will give instructions for remedial works to be carried out by the Contractor at the expense of the Contractor.

Where channels are to be reshaped, cleared and trimmed, the width, depth, side slopes and centre line radius shall be as shown on the Drawings. The Contractor shall clear all weeds and growth from existing channels and grade the beds to required levels. The area of waterway shown is the minimum required and sides of channels shall be trimmed to the required slope so as to provide widths not less than those shown on the Drawings.

Any channels, streams, drains or pipes taking water to or from cultivated land shall be diverted so as to maintain their flow before being moved or broken into unless express permission to the contrary is given by the Engineer. All diversions and their subsequent reinstatement are to be carried out to the satisfaction of the Engineer. The Contractor shall be deemed to have included the cost of dealing with this in his rates.

Side banks of channels shall be trimmed to a neat appearance and even surface.

In the construction of channels and embankments a local balance of cut and fill shall be maintained as far as possible unless the cut is unsuitable material or is specified in the drawings that the fill should be imported. A deficiency of fill material shall be made up by bed borrow or gleaning. Surplus material, if suitable and approved by the Engineer may be used for an increased width of embankment otherwise it may be spread at the toe of the embankment or placed on spoil tips as directed by the Engineer.

Where required the Contractor shall control the rates of filling and draw-down of water in channels so as not to endanger the stability of earthworks.

Disposal of Excavated Material

Material obtained from excavations which are suitable for forming embankments or other fill areas shall be placed directly in the Works or set aside for use as and when required in suitable approved dumps. Any such suitable material which may be surplus to the total requirements of the Works shall be taken to spoil in tips provided by the Contractor, unless otherwise provided or permitted by the Engineer.

If the Contractor is permitted to remove suitable material from the site to suit his operational procedure or to take such material for purposes other than forming embankments or other fill areas, he shall make good any consequent deficit of filling arising there from, unless otherwise agreed by the Engineer.
All material not suitable for embankments or other filling shall, unless otherwise directed by the Engineer, be taken to separate spoil tips provided by the Contractor.

The cost of disposal of surplus or unsuitable materials shall be deemed to be included in the respective unit rates for the excavation work and the Contract Sum.

**Spoil Tips**

The Contractor shall be responsible for the provision and sufficiency of tips for the permanent disposal of spoil and shall select their location within the general areas as designated or approved by the Engineer. The Contractor shall submit his proposals for the locations and detailed treatment of tips to the Engineer for approval, which will in no way relieve the Contractor of his responsibilities and obligations under the Contract, whether or not locations are shown on the Drawings or otherwise designated.

No spoil shall be permanently deposited elsewhere than on approved spoil tips unless approved by the Engineer. Spoil tips shall be built up and compacted and trimmed and regulated to levels and profiles approved by the Engineer. Where directed by the Engineer, upper surfaces and slopes of the tips shall be soiled to specified thickness.

**Borrow Pits and Quarries**

Where there may be an insufficiency of suitable material from excavations for filling or is specified on the drawings, the Contractor shall obtain such material from borrow pits or quarries approved by the Engineer where the filling is required for Permanent Works. The Engineer may propose a borrow pit for exploration by the Contractor, however, it shall be entirely the responsibility of the Contractor to locate suitable sources of borrow material for fills.

The Contractor shall investigate the site or sites which they propose to open up and shall provide full and detailed information by means of boreholes, trial pit testing reports, etc. to satisfy the Engineer that the quality of the material meets Specification requirements and that the quantity is adequate for the Works.

Notwithstanding the foregoing, the Engineer shall have the right to order the Contractor to obtain materials from a particular designated source or by widening cuttings for permanent works beyond specified profiles.

The Contractor shall provide plant and equipment and make all other arrangements for excavating, loading and transporting material of the specified quality for completion of the Works in accordance with the agreed programme. These provisions shall include where necessary for any operations involving selection, stockpiling and rehandling of suitable material, the disposal of unsuitable material or overburden and any other operations which may be found necessary due to the nature and disposition of the excavated materials.

The pits and quarries shall be operated in a safe manner provided with ample drainage leaving no stagnant pools. On completion of the Works they shall be left free-draining and in a tidy and regular state. All loose material shall be barred down and no face shall be left overhanging except with the approval of the Engineer.

The removal of vegetation, topsoil and overburden at the borrow pits shall not be paid for separately. Contractor will be deemed to have allowed for the costs elsewhere in his rates. The same applies to any works required to access the borrow pits.
The rate for fill shall include for the supply, processing and compaction of material inclusive of extraction, loading and transportation to Site for a maximum haulage distance of 30 km, one way. Where suitable borrow pit is not available within this distance, overhaul will be paid for. Measurement shall be the product of the volume of compacted material in situ and the haulage distance in excess of 30 km, one way, along the shortest route, as determined by the Engineer. The Contractor shall be responsible for the maintenance of this selected route, at his own cost.

**Earth Filling**

Material for filling shall be obtained from approved sources and shall not contain more than 1% of vegetation matter, rubbish and humus material and shall contain no boulders or rock of a size greater than half the compacted thickness of the layer. No material shall be used which is so uniformly graded that D60 divided by D10 is 4 or less, where D60 and D10 are sizes such that 60% and 10% by weight of the particles are finer than D60 and D10 respectively.

Unless otherwise specified the fill material for the canal and stilling basin embankments shall meet the following requirements:

(a) CBR after 4 days soaking compacted to 100% of AASHTO T99 at optimum moisture content of not more than 3%.

(b) Plasticity Index (PI) of not more than 40%.

(c) Permeability of less than $1 \times 10^{-6}$ mm/s

Prior to commencement of filling, the Contractor shall submit in writing to the Engineer for approval his proposals for carrying out the work such that the optimum use may be made of excavated material as far as possible. The proposals shall include the compaction plant and methods for adjusting the moisture content of the material which he intends to use. No filling shall be carried out until the proposals and the material intended to be used are approved by the Engineer.

Fill shall be placed in layers not exceeding 150 mm compacted thickness, each layer being scarified and thoroughly compacted to obtain a dry density of not less than 95% of the maximum dry density as determined by AASHTO T99. The moisture content shall be adjusted as necessary to achieve the compaction standards. All silt or mud shall be removed from the base and sides of canals before the commencing the filling. Fill on canal side slopes shall allow benching of a minimum 500mm width for each two successive 150mm compacted layers.

The Contractor shall take all necessary measures to prevent any damage or defects to the Works which may be caused by settlements, slips or falls of embankments and shall make good such damage or defects as may occur to the satisfaction of the Engineer, all at his own cost.

Any instability of any adjacent excavation resulting from the embankment not being formed to the lines, levels and profile shown in the Drawings or as ordered by the Engineer will be the responsibility of the Contractor. Where double-handling of excavated material is necessary, the Contractor will be responsible for the temporary disposition of the material such that it does not endanger the stability of the excavation.

**Backfilling of Structural Excavations**

Backfilling of structural excavations shall be carried out with excavated material selected or approved by the Engineer. The material shall be placed in layers not exceeding 150 mm compacted thickness or such other thickness as the Engineer may approve or direct and shall be compacted as specified in Clause 2.16.
When material is filled up to or over any structure, the filling shall be brought up equally on each side or as otherwise agreed by the Engineer so that no unequal pressures likely to cause damage to the structure are applied.

Filling under raised foundations

The material to be used as filling under raised foundations shall consist of suitable material obtained from adjacent excavations or approved borrow sources, and shall be placed in layers not exceeding 150 mm compacted thickness. The material shall be compacted in accordance with Clause 2.16.

Frequency of Testing

Testing will be carried out as instructed by the Engineer with the following being the minimum testing frequencies:

- Field Dry Density Moisture Content Test. Every 500 square meters of compacted fill layer placed or at least 3 tests in any one length of compacted fill, whichever is greater.
- Particle Size Sieving Analysis, Atterberg Limits and AASHTO T180 test. Every 1000 cubic meters of compacted fill or at least 3 tests in any one length of compacted fill, whichever is greater.

The apparatus for these tests and the manner in which they are carried out will be as described in BS 1377/1990 and AASHTO T99. All results of these tests shall be submitted to the Engineer with the least possible delay.

Granular Bedding

Granular bedding material shall comply with BS 882 for aggregates within the sizes range 14 mm to 5 mm. Material complying with BS 882 except in respect of grading may be used provided that it has a maximum size not exceeding 14 mm.

Slopes and Batters

Where a slope is given in the Specification or on the Drawings as a ratio of vertical and horizontal components, it shall be understood that the first component is vertical in all cases e.g. a "slope of 1 in 2" will mean one vertical in two horizontal and a "batter of 4 to 1" will mean four vertical to one horizontal. This meaning will be attributed to all other terms such as "inclination" and "gradient".

Trial Pits

The Contractor shall excavate, maintain and afterwards refill any trial pits ordered by the Engineer. The sides of the pits shall, where deemed necessary by the Engineer for safety purposes, be supported by sheeting or boarding with adequate framing. A ladder shall be provided for inspection purposes.

Sheet Piling

Where shown on the drawings or instructed by the Engineer the construction of sheet piling shall comply with the codes of practice for earth retaining structures, BS 8002: 1994.

CONCRETE

Concrete General

Concrete shall consist of cement, graded aggregate (coarse and fine) and water carefully proportioned, thoroughly mixed, placed and compacted as specified.

The Contractor shall obtain formal approval from the Engineer before pouring any concrete for the permanent works. The Engineer shall allow concreting after ascertaining the required lines and levels, suitability of formwork, availability of required plant and labour, proper fabrication and spacing of the steel bars and quality and quantity of cement and aggregates.

Cement

Cement for use in the permanent works shall be Ordinary Portland Cement from approved manufacture and shall comply with BS 12. Where sulphate-resisting cement is specified, it shall comply with BS.4027.

All cements shall be certified by the manufacturers as complying with the requirements of the specification. Before orders are placed the Contractor shall submit details of the proposed supplier(s) together with such information on the proposed methods of transport, storage and certification so that the Engineer may satisfy himself that the quantity and quality required can be supplied and maintained throughout the construction period. Where necessary the Engineer may require representative samples of the proposed cement to be taken and forwarded to a nominated laboratory for analysis and testing before the source is approved.

No cement shall be used in the Works until deemed satisfactory by the Engineer.

Supply of Cement

Cement shall be obtained from one manufacturer unless otherwise authorised by the Engineer. Should the use of cement from different manufacturers be authorised, the different supplies of cement shall be stored separately and shall not be mixed.

The Contractor shall supply to the Engineer copies of the manufacturer's test certificates certifying that each consignment of cement has been tested and analysed in accordance with Clause 3.5 of the specifications, and that the results comply in all respects with the above standards. Each certificate shall state clearly the date of despatch and the number of bags despatched in each consignment.

Bagged cement shall be delivered in sealed 50 kilogramme sacks. Each bag shall be marked with the parcel number of the cement contained. Bagged cement shall be transported so that at no time is it exposed to damp and so that moisture cannot be absorbed from the atmosphere. Cement in bulk shall be transported in totally enclosed water tight and sealed containers.
If cement is obtained from an intermediate agent, such agent’s arrangements for transporting and storing cement shall be to the approval of the Engineer.

Storage of Cement

The Contractor shall provide sufficient storage capacity on Site to ensure that his anticipated programme of work is not interrupted due to lack of cement. Factors outside the Contractor’s control such as transport, weather conditions, holidays and breakdowns shall be taken into account.

Cement delivered to the Site in bulk shall be stored in dry, well ventilated weather proof silos or bins which shall be self clearing. Cement delivered to the Site in bags shall be stored in dry, weather-proof sheds which shall have floors of damp proof construction raised at least 150 millimetres above the surrounding ground.

Cement of different consignments shall be stored separately and consignments shall be used in the same order as they are delivered to the site. No cement shall be stored on the site for longer than three months from the date of despatch by the manufacturer. If not used within that period, the cement shall be removed from the site.

Any bag of cement which is damaged or found to contain cement which has set or partly set, shall be discarded and not used in the permanent works.

Testing of Cement

Cement shall be tested by the manufacturer. If the manufacturer's test certificate is not made available, representative samples shall be taken from different bags or containers of each consignment. They shall be suitably packed and sent to an approved laboratory for testing to prove the cement’s compliance with the specified standards.

The Engineer may require cement to be tested after its delivery to the site. Any cement which has been in store at the site for longer than one month shall be re-tested.

The Engineer may take samples of cement from cement bins or bagged cement, from a parcel of cement after its delivery to the site, or from a parcel of cement which has been stored at the site for longer than one month.

In addition to the manufacturer's tests the Engineer may require the following tests to be carried out:

(a) Comprehensive strength on mortar cubes in accordance with Method 1 of Clause 6A of BS.12

(b) Soundness in accordance with Clause 9 of BS.12.

Any cement which fails to meet the specified requirements shall not be used in the Permanent Works.

Aggregate for Concrete

General

Aggregates for concrete shall comply with BS 822, and shall be obtained from a source or sources approved by the Engineer and shall be transported and stored in such a manner as will prevent:


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(a) Contamination of the aggregates from the ground, rubbish, vegetation, dust or any other foreign material.
(b) Segregation.
(c) Intermixing of aggregates of differing characteristics.

Before aggregates from each source are approved for use in the Permanent Works, tests shall be carried out at an approved testing laboratory on representative samples submitted by the Contractor to check that the aggregates comply with the requirements of the Specification.

During concreting operations, tests shall be carried out to check that aggregates delivered for use in the Permanent Works comply with the requirements of the Specification.

Sampling and testing of aggregates for concrete shall be carried out in accordance with the requirements of BS 812 except where described otherwise.

Moisture contents of aggregates shall be determined as the moisture content of the aggregate compared with that of the aggregate in the saturated surface-dry condition. Specific gravities of aggregate shall be determined on aggregate in the saturated surface-dry condition.

Aggregates shall be stored on a clean, free draining surface. The various types and sizes of aggregates shall be kept separate from each other and each stockpile shall be kept as large as possible to maintain a reasonably uniform content in the aggregate.

**Fine Aggregates**

Fine aggregates shall be clean 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 millimetre BS sieve and the grading shall be in accordance with Zones 1, 2 or 3 of BS 882. In order to achieve an acceptable grading, it may be necessary to blend materials from more than one source.

As an alternative, fine aggregate for mortar only shall comply with BS 1199 and 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 unless the Contractor can show by tests on finished concrete as set out in BS 1881 that the presence of such materials does not adversely affect the properties of the concrete.

The proportion of clay, silt and other impurities passing a 75 microns BS sieve shall not exceed three per cent for natural or crushed gravel sand or 15 per cent for crushed rock sand. The shell content shall not exceed 15 per cent by weight.

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 to the further restriction given in the note on total chloride content in sub-clause 3.5.5.

Soundness: After five cycles of the test set out in ASTM C88-76, the aggregate shall not show a weight loss of more than 10 per cent.

Samples taken from the fine aggregate shall pass the colour test for organic impurities described in sub-clause 3.6.4.

Tests on fine aggregates shall be carried out daily or as required by the Engineer on site during concreting operations as follows:

(a) Sieve analysis
(b) Moisture content. An approved "rapid" test may be used for this test.

(c) Percentage of material passing a 75 microns BS sieve by the Field Settling Test, checked when necessary by the Decantation Method.

(d) Test for organic impurities as described in sub-clause 3.5.4.

The Contractor shall arrange to carry out the following tests when requested by the Engineer:

(e) Specific gravity and water absorption.

(f) Bulk density.

(g) Other tests described in BS 812.

Coarse Aggregates

Coarse aggregates shall be clean, hard and durable crushed rock, crushed gravel or natural gravel complying with the requirements of BS 882. The material shall be frost resistant and shall not contain any iron pyrites, iron oxides, flaky or laminated material, hollow shells, coals or other soft or porous material, or organic matter. The pieces shall be predominantly angular, rounded or irregular as defined in BS 812.

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.

The proportions of clay, silt and other impurities passing a 75 microns 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 out in BS 1881. The total shell content shall not be more than the following:

- 40mm nominal size and above: 2 per cent of dry weight
- 20mm nominal size: 5 per cent of dry weight
- 10mm nominal size: 15 per cent of dry weight

Chlorides soluble in a 10 percent 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 on total chloride content given in sub-clause 3.5.5.

When tested in accordance with ASTM C289, the aggregate shall be non-reactive.

Soundness: After 5 cycles of the test set out in ASTM C88-76, the aggregate shall not show a weight loss of more than 12 per cent.

Flakiness Index: When tested in accordance with BS 812 shall be as set out hereunder:

- 40mm nominal size and above: Not more than 40
- 20mm nominal size and below: Not more than 34

If the flakiness index of the coarse aggregate varies more than five units from the average value of the aggregate used in the approved trial mix, a new set of trial mixes shall be carried out in the workability of the mixes have been adversely affected by such variation.

Impact Value: Not more than 45 per cent when tested in accordance with BS 812.

Ten per cent fines value: Not less than 50 kilonewtons when tested in accordance with BS 812.
Shrinkage: When mixed with other ingredients in the approved proportions for concrete and tested as set out in BS 1881, the shrinkage factor shall not exceed 0.05 per cent.

Water absorption: The aggregate shall not have a water absorption of more than 2.5 per cent when tested as described in BS 812.

Tests on coarse aggregate shall be carried out daily or as required by the Engineer on site during concreting operations as follows:

(a) Sieve analysis

(b) Moisture content: An approved "rapid" test may be used for this test.
(c) Percentage of materials passing a 75 microns BS sieve by the Field Settling Test, checked when necessary by the Decantation Method.

The Contractor shall arrange to carry out the following tests when requested by the Engineer:

(d) Determination of flakiness index.

(e) Specific gravity and water absorption.

(f) Determination of "ten per cent fines” and of Los Angeles Abrasion.

(g) Other tests described in BS 812.

Test for Organic Impurities

Aggregates shall be tested for organic impurities by means of discoloration of a sodium hydroxide solution as follows:

A 340 millilitres graduated prescribed bottle shall be filled to the 123 millilitres mark with a sample of the aggregate to be tested. A 3 per cent solution of sodium hydroxide in water shall be added until the volume of the aggregate and liquid after shaking gives a total volume of 194 millilitres. The bottle shall be stoppered, shaken thoroughly and allowed to stand for 24 hours. Should the liquid then be darker than the standard colour solution the aggregate shall not be used for making concrete.

The standard colour solution shall be prepared in a 340 millilitres prescription bottle as follows:

2.5 millilitres of a 2 per cent solution of tannic acid in 10 per cent alcohol shall be added to 97.5 millilitres of a 3 per cent solution of sodium hydroxide in water. The mixture shall be shaken and allowed to stand for 24 hours.

A glass of the standard colour may be used in place of the standard solution.

Total Chloride and Sulphate Contents

The total chloride content arising from all ingredients in a mix, expressed as chloride ions as a percentage of the weight of cement in a mix, shall not exceed 0.5 per cent in any one sample nor 0.3 per cent in 95 per cent of the samples tested. For pre-stressed concrete, steam cured concrete or concrete containing sulphate resisting cement or super sulphated cement, the total chloride content shall not exceed 0.5 per cent of the weight of cement in the mix.

The total sulphate content arising from all ingredients in a mix shall not exceed 0.4 per cent by weight of the aggregates or 4 per cent of the weight of cement in the mix, whichever is less. For this purpose the sulphate contents shall be expressed as $SO_3$ and shall be calculated form the sulphate contents of the cement, aggregates and any admixtures. Where applicable, sulphate contents shall be determined in accordance with tests described in BS 1047 and 3892.

Pulverised fuel ash shall not be used in conjunction with a cement complying with the requirements of BS 4027 in concrete required to be resistant to sulphates.

Admixtures

Admixtures for improving workability, accelerating or retarding setting of concrete, or for any other purpose, shall only be used with the Engineer's written approval. Calcium chloride or admixture containing chlorides will, however, not be approved.

The Contractor shall submit samples of the admixtures he proposes to use to the Engineer for testing. If an admixture is approved for use it shall be obtained from an approved supplier and the Contractor’s arrangement for measuring, mixing and adding the admixture to the concrete batch shall be strictly in accordance with the manufacturer’s instructions or recommendations and subject to the approval of the Engineer.

The proportions of the concrete mixes and water/cement ratio shall be adjusted to the satisfaction of the Engineer so that the strength of the concrete with admixture is at least equal to the strength of the equivalent concrete without admixture.

Water for Concrete

Clean fresh water is to be used for the mixing of all concrete and mortar, and is to be from a source approved by the Engineer. If required by the Engineer, samples shall be taken from the proposed source of supply and submitted to a nominated laboratory for testing in accordance with BS 3148, “Methods of test for water for making concrete” and on the results of these tests the Engineer will decide whether the source is acceptable.

Concrete Mixes

The design of concrete mixes shall be the sole responsibility of the Contractor, but may be undertaken in conjunction with the Engineer. Concrete mixes shall be designed mixes in accordance with the requirements of BS 5328 having the characteristics specified in Table 3.1 of this Specification. Concrete for use in water retaining structures shall comply with BS 8007.

Evidence shall be submitted to the Engineer, for all classes of concrete to be used, showing that at the intended workability the proposed mix proportions and production methods will produce concrete of the required quality.

The following information shall be provided before any designed mix is supplied:

(a) Nature and source of each material.

(b) Full details of tests on trial mixes including workability.

(c) Proposed quantities of each ingredient for one cubic metre of fully compacted concrete.

No change in the approved mix design will be permitted, unless the Contractor carries out trials on the proposed mix design to show that compliance with this Specification can be maintained.

Mix design shall in all cases be subject to the approval of the Engineer, but such approval shall in no way relieve the Contractor of his responsibility for the design and production of concrete in compliance with this Specification.

Trial Mixes

At least six (6) weeks before commencing the placing of any concrete in the works, trial mixes shall be prepared for each class of concrete to be used on the works. Three (3) batches of each class of concrete shall be made using materials typical of the proposed supply and under full scale production conditions.
The workability of each of the trial batches shall be determined and three (3) cubes made from each batch for testing at 28 days. A further three (3) cubes made from each batch may be made for tests at an earlier age if required.

The trial mix proportions shall be approved if the average compressive strength of the nine (9) cubes tested at 28 days exceeds the specified characteristic strength by 3 Newtons per square millimetre, or if nine tests at an earlier age indicate that it is likely to be exceeded by this amount.

To demonstrate that the maximum free water/cement ratio is not exceeded, two batches of concrete shall be made in a laboratory with cement and surface-dry aggregate known from past records of the supplier of the material to be typical. The proposed mix proportions will not be accepted unless both batches have the cement content specified and free water/cement ratio below the maximum specified in Table 3.1.

### Table 3.1 - Classes of Concrete

<table>
<thead>
<tr>
<th>Class</th>
<th>Characteristic Compressive Strength N/mm²</th>
<th>Maximum Free Water/cement Ratio</th>
<th>Minimum Cement Content kg/m³</th>
<th>Maximum Cement Content kg/m³</th>
<th>Maximum Aggregate Size mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>C25/10/A</td>
<td>25</td>
<td>0.55</td>
<td>360</td>
<td>400</td>
<td>10</td>
</tr>
<tr>
<td>C25/20/A</td>
<td>25</td>
<td>0.55</td>
<td>360</td>
<td>400</td>
<td>20</td>
</tr>
<tr>
<td>C25/20/B</td>
<td>25</td>
<td>0.55</td>
<td>290</td>
<td>400</td>
<td>20</td>
</tr>
<tr>
<td>C25/20/C</td>
<td>25</td>
<td>-</td>
<td>240</td>
<td>540</td>
<td>20</td>
</tr>
<tr>
<td>C20/20/B</td>
<td>20</td>
<td>0.55</td>
<td>290</td>
<td>400</td>
<td>20</td>
</tr>
<tr>
<td>C20/40/B</td>
<td>20</td>
<td>0.55</td>
<td>260</td>
<td>400</td>
<td>40</td>
</tr>
<tr>
<td>C20/40/C</td>
<td>20</td>
<td>-</td>
<td>220</td>
<td>540</td>
<td>40</td>
</tr>
<tr>
<td>C15/40/C</td>
<td>15</td>
<td>-</td>
<td>180</td>
<td>540</td>
<td>40</td>
</tr>
<tr>
<td>C15/20/C</td>
<td>15</td>
<td>-</td>
<td>180</td>
<td>540</td>
<td>20</td>
</tr>
<tr>
<td>C10/40/C</td>
<td>10</td>
<td>-</td>
<td>150</td>
<td>540</td>
<td>40</td>
</tr>
</tbody>
</table>

A, B and C denote exposure conditions for the finished concrete as defined in BS 8007.

### Testing of Concrete

#### General

All concrete shall be sampled and tested in accordance with the requirements of BS 1881 unless otherwise stated in this Specification or instructed by the Engineer.

The Contractor shall allow for all the necessary labour, materials, plant and equipment necessary for the regular sampling and testing of concrete to be placed in the Works.

#### Cement Content

Tests shall be carried out as required by the Engineer to determine the cement content of the mix. The cement content of any batch of concrete shall not be less than the specified minimum value minus 5 per cent of that value nor more than the specified maximum value plus 5 per cent of that value.

#### Workability

The workability of the concrete shall be measured as required by the Engineer by slump tests or compaction factor tests and shall be within the following limits:

- Slump $\pm 25\text{mm or } \pm \text{ one third of required value whichever is greater.}$
- Compacting Factor $\pm 0.03$ where required value is $0.90$ or more
- $\pm 0.04$ where required value is $0.90$ to $0.80$
- $\pm 0.05$ where required value is $0.80$ or less

The required value shall be that which has been accepted under Clause 3.8 of this Specification.

**Water/Cement Ratio**

The water/cement ratio shall be determined as required by the Engineer and shall not exceed the specified maximum value by more than $5\text{ per cent of that value.}$

**Compressive Strength**

Samples of concrete shall be taken for compressive strength at a rate of one sample per $15$ cubic metres of concrete placed or $15$ batches of concrete placed whichever is the lesser volume. A greater frequency of sampling may be instructed by the Engineer until compliance with specified strength requirements has been confirmed for each class of concrete used in the Works.

Two test specimens shall be prepared from each sample and shall be cured for $28$ days, or by any other method approved by the Engineer that enables the prediction of $28$ day strength at an earlier time.

On completion of curing, the two test specimens shall be tested. Provided the difference between the two results does not exceed $14\text{ per cent of the mean of the two results, the mean shall be taken as the test result.}$ Where the difference between the two results exceeds $14\text{ per cent of their mean,}$ the lower of the two results shall be taken as the test result.

Compliance with the specified strength may be assumed if the conditions given in both (a) and (b) below are satisfied.

(a) The average compressive strength determined from any one group of four consecutive $28$ day test results exceeds the specified characteristic strength by not less than $3$ Newtons per square millimetre for classes of concrete C20, C25 and C30 and not less than $2$ Newtons per square millimetre for class C15 concrete.

(b) Each individual $28$ day test results is greater than the specified characteristic strength minus $3$ Newtons per square millimetre for classes of concrete C20, C25 and C30 or $2$ Newtons per square millimetre for class C15 concrete.

If only one tests result fails to meet the second requirement then that result may be considered to represent only the particular batch of concrete from which that sample was taken provided the average strength of the group satisfies the first requirement.

If more than one result in a group fails to meet the second requirement or if the average strength of any group of four consecutive test results fails to meet the first requirement, then all the concrete in all the batches represented by all such results shall be deemed not to comply with the strength requirements. For the purposes of this Clause, the batches of concrete represented by a group of four consecutive test results shall include the batches from which samples were taken to make the first and the last tests in the group of four, together with all the intervening batches.
Failure to Comply with Specified Requirements

Failure of concrete to comply with the specified requirements will result in it being classified as defective work. Immediately on notification by the Engineer that concrete work is defective, the Contractor shall take all measures necessary to improve concrete quality before further concrete is placed in the Works. If required by the Engineer, the rate of sampling of concrete shall be increased until adequate control is again established. Tests shall be carried out on the defective concrete or test cores taken from it to establish its in-situ strength. If the results of these tests satisfy the Engineer that the defective concrete will fulfil its design function then it may be accepted. If not, the Contractor shall propose strengthening or remedial work where possible or shall remove the defective concrete from the Works.

Concrete Returns and Records

The Contractor shall send weekly to the Engineer a return showing the quantities of cement and the number of mixings of each class of concrete used in each section of the Works.

Records shall be kept by the Contractor of the positions in the Works of all batches of concrete, of their class and of all test cubes or other specimens taken from them. Copies of these records shall be supplied to the Engineer.

Plant, Equipment and Construction Procedure

The design, layout, installation and operation of plant and equipment for processing, handling, transporting, storing and proportioning concrete ingredients and for mixing, transporting and placing concrete shall be to the satisfaction of the Engineer. Before the plant and equipment is ordered or delivered to site, the Contractor shall submit to the Engineer drawings showing the proposed arrangements of the plant together with detailed descriptions of the equipment proposed.

Batching

The aggregates and cement shall be proportioned by means of efficient weigh batching machines except when the Engineer has approved the use of volume batching. The machines shall be carefully maintained and cleaned and they shall be provided with simple and convenient means of checking the accuracy of the weighing mechanism, and they shall be checked when required by the Engineer.

For volume batching suitable gauge boxes shall be used.

Mixing Concrete by Machine

Where the concrete is to be mixed in machines, these shall be of the batch mixing or other approved type. The machines shall ensure that all the concreting materials including the water are thoroughly mixed together before any portion of the mixture is discharged. The mixing time shall not be less than thirty seconds per cubic foot (30sec/cft) of concrete, with a minimum of three minutes (3min) mixing time per batch. The machines must be capable of discharging their contents while running.
Mixing Concrete by Hand

Where it is not possible to employ machine mixing and approval has been obtained from the Engineer, concrete shall be mixed by hand as near as practicable to the site where it is to be deposited. Clean mixing bankers or platforms of sufficient area for the proper execution of the work shall be provided. These platforms if constructed of timber shall consist of planks closely jointed so as to avoid the loss of any grout or liquid from the wet concrete. The whole of the aggregate and cement shall be turned over on the banker in a dry state at least twice. The water shall then be added gradually through a rose head, after which the materials shall again be entirely turned over in a wet state at least three times.

Preparation of Surface to Receive Concrete

Foundations which are to receive concrete shall be properly drained and dewatered so that no water runs over or stands on a surface on which concrete is being placed. If required by the Engineer drains provided through or beneath concrete for the temporary conveyance of water shall afterwards be completely sealed to the Engineer's approval.

Before deposition of concrete against rock, the rock surface shall be thoroughly wetted and cleaned by the application of water, or of water and air, under pressure. No concrete shall be deposited until the surface has been cleaned and passed as satisfactory by the Engineer.

Faults or seams in the rock shall be cleaned to a depth satisfactory to the Engineer and if necessary stemmed with cement mortar of an approved mix.

Before any steel reinforcement is embedded in the concrete any loose mill scale, loose rust and any oil, grease or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operations shall likewise be removed.

Authority to Commence Placing of Concrete

The Contractor shall give the Engineer at least 24 hours notice of his intention to place concrete in a particular section of the Works. Before concrete is placed the Contractor shall apply to the Engineer for approval of the cleanliness, alignment and suitability of surfaces against which the new concrete is to be placed and of the fixing of formwork, reinforcement, embedded parts and the like and he shall obtain written permission from the Engineer to proceed with concreting.

The Contractor shall carefully plan his concreting operation to ensure, where possible, that these operations are completed within the normal working day.

Dimension of Concrete Pours and Programme of Placing

Unless otherwise approved by the Engineer concrete shall be cast in one operation between external faces of concrete and joints shown on the Drawings or between construction joints or both.

The Contractor shall submit and obtain the Engineer's approval to a detailed concreting programme and his proposals for the location of construction joints.
Transport and Deposition of Concrete

Concrete shall be transported and deposited in such manner as to prevent segregation, loss of materials or contamination with foreign matter. The means of transport of concrete shall be subject to the approval of the Engineer. The containers for conveying the concrete shall be thoroughly cleaned immediately after use and sides dampened before work is started or restarted to prevent cement and fine material in the first batch adhering to the sides. Adequate precautions shall be taken to protect the concrete against wetting or drying out through exposure to the weather and to prevent segregation and consolidation of the mix due to prolonged jolting of the concrete. Concrete shall be placed in its final position and fully compacted before the onset of initial set. Wherever possible, concrete shall be deposited vertically in the final position required and shall not be dropped through a greater height than 1.5 m. Where necessary, bins, drop chutes, down pipes or baffles shall be provided to prevent segregation of the material. Drying out of fresh concrete before deposition shall be prevented by the provision where necessary of suitable covers. Loss of slump during transport and deposition of the concrete shall not exceed 25 millimetres.

Concrete shall not be placed in standing or running water unless so specified. Where concrete has to be placed under water, the Contractor shall submit to the Engineer his proposals indicating the methods and equipment to be employed. The concrete shall be deposited 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 bottoms 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 and additional cement of about 25% must be added.

Distribution and Spreading of Concrete

Concrete shall be placed in layers not exceeding 500 millimetres in depth approximately parallel to the horizontal or inclined construction joint planes. These layers shall be deposited from one face to the other until the full height of the lift is reached. Each layer shall be deposited on the previous one before the latter has taken its initial set and the exposed area of fresh concrete shall be maintained to the practical minimum. In order to accomplish this timing a new layer may be started before the previous layer is completed.

The face from which placing of concrete is to commence shall be selected so that if an emergency should occur which prevents the layer being completed the vertical construction joint will be formed in a structurally acceptable position.

Concrete shall not be placed during rain sufficiently heavy or prolonged to wash mortar form coarse aggregate on the exposed sloping faces of fresh concrete unless adequate shelter is provided.

Concrete shall not be placed against any surface (including formwork, reinforcement, embedded steelwork, adjacent concrete or rock) which during hot weather is not adequately dampened to prevent excessive absorption of water from the fresh concrete.

Once commenced, concreting shall be carried on as continuous operation between pre-arranged construction, expansion or contraction joints save only if an emergency occurs and interruption is unavoidable. The Contractor shall have readily available suitable prefabricated formwork for stop ends to form emergency vertical construction joints and, in the event of such an interruption occurring, the concrete already placed shall be properly finished up to the stop end and to a horizontal or inclined surface as directed by the Engineer. In water retaining structures the Contractor shall propose methods of making the joint watertight.

Concrete shall be placed carefully so as not to displace the formwork or reinforcement.
Compaction of Concrete

The Contractor shall thoroughly compact all concrete immediately after it has been placed in position. Unless otherwise authorised by the Engineer, compaction shall be accomplished with the aid of immersion vibrators as specified below, together, if necessary, with rods, shovels and the like. Particular care shall be taken to fill all voids and to work the concrete against rock and existing concrete surfaces, round any reinforcement and embedded fixtures and into the corners of the formwork.

If the Contractor does not wish to use immersion vibrators for any portion of the works he shall submit his proposals for alternative vibrators or compaction equipment and shall receive the Engineer's approval to the equipment before commencing to concrete the portion concerned.

Vibrators shall be of a type and size adequate for the portion placed. Vibrators shall operate at a frequency of between 7000 and 10000 impulses per minute. The Contractor shall ensure that vibrators are operated at pressures and voltages not less than those recommended by the manufacturer in order to ensure that the compactive effort is not reduced.

A sufficient number of vibrators shall be operated to enable 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 concreting place. The length and diameter of the vibrating element of immersion vibrators shall be sufficient to penetrate through the layer of concrete being placed and re-vibrate the upper portion of the underlying layer of concrete.

Only men experienced in the use of vibrators shall be employed on this type of work.

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 ceased to appear. The period of vibration necessary shall be determined by trial in the presence of the Engineer. Vibration shall then be continued for this period at each point before any further concrete is superimposed.

Immersion vibrators shall be inserted vertically to penetrate into the layer underneath at regular intervals, which shall not exceed the distance from the element over which vibration is visibly effective and in any case shall not exceed 700 millimetres. Vibrators shall not be used to move concrete laterally and shall be withdrawn slowly to prevent the formation of voids. Vibrators shall not be applied to reinforcement or other embedded items.

Protection of 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 this cause.

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 Permanent Works shall not be subjected to any structural loading until it has attained at least its nominal strength.

If the Contractor desires to impose structural 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.

No Partially Set Concrete shall be used

All concrete must be placed and compacted in its final position within thirty minutes (30min) of discharge from the mixer unless otherwise approved. No partially set material shall be used in this work.

Plum Concrete

Plums shall be hard clean natural stones embedded in mass concrete during the placing of the concrete. Unless otherwise shown on the drawings, the plums shall not be larger than one third of the cross section of the concrete and should not be placed closer than 150 mm to each other vertically and 100mm horizontally. The volume of plums shall unless otherwise specified, not exceed forty per cent (40%) of the mass concrete volume and care shall be taken to ensure that the minimum cover over any plums is 100mm.

Concrete canal lining

Earth filling

The canal shall be properly formed to the required shape, grade and alignment. Earth filling and compaction for the sub-grade on canal base and banks shall be carried out to ensure a firm foundation in accordance with the provisions of this Specification covering Earthworks (embankment to be thoroughly compacted by hand-tamping, rolling or water soaking. New embankments should be in compacted in 150mm layers). The sub-grade shall be wetted several hours before the lining to ensure that the sub-grade is saturated at the commencement of lining.

Concrete works

Concrete works in lining shall be carried out in accordance with the provisions of this Specification covering Concrete Works. Special attention shall be paid to the concrete mix to ensure that it is properly controlled to avoid it creeping downward from the sides.

The thickness of the concrete lining shall be 75mm or as directed by the Engineer. Where a completed section has a thickness less than that specified, it will be removed and replaced. Plastering or other methods of building up the lining thickness will not be allowed.

Concrete canal linings will be placed in-situ and in panels of 2 - 3 m lengths and be constructed in alternate bays, so that at least 24 hours elapse between the completion of one panel and the start of lining of an adjacent panel. This will be in order to maintain uniform spacing for the joints. Screed guides shall be used to maintain the desired grade and thickness of the lining during laying of the concrete. Any other method of constructing the lining will require the approval of the Engineer. In forming the concrete (screeding operation) at least three passes with a wooden plank, or any other method chosen by the contractor and approved by the Engineer, are necessary in order to maintain the shape and the inside of the canal. After completing the required number of passes, the concrete will be immediately floated (smoothening of the surface with a wooden plank) and troweled to produce the specified finish. Striking off, or removal of any concrete from the consolidated surface by means other than those used in the construction, will not be permitted.

Curing of concrete shall be carried out in accordance with the provisions of this Specification covering Concrete Works (proper curing by keeping the concrete damp by sprinkling or by covering with wet gunny bags).

Expansion and shrinkage joints

Expansion and shrinkage joints shall be formed at 2 - 3m intervals in the position and manner shown on the Drawings or as directed by the Engineer. Grooves shall be formed on the joints as shown in the drawings.

The minimum Width:Depth (W/D) ratio of the sealant material shall be 2:1. The remaining thickness shall be filled with joint filler material as shown in the drawings. The edges of the previously laid concrete shall first be painted with a suitable sealing compound preferably Sika Primer 3 or equivalent to prevent bonding. After the curing period, the grooves shall be filled with the hot sealing compound (Sikaflex-11FC or equivalent) at the rate of about 0.25 litres per square metre over a primer coat.

After the sealant has been applied to the joint, it can be smoothed using a spatula lubricated with diluted washing-up liquid (10:1 dilution).

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**Concreting in Adverse Weather**

No concreting will be allowed to take place in the open during storms or heavy rains. Where strong winds are likely to be experienced additional precautions to ensure protection from driving rain and dust shall also be taken.

The Engineer may withhold approval of commencement of concreting until he is satisfied that full and adequate arrangements have been made.

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**Concreting at Night or in the Dark**

In general, concrete works will not be permitted to be carried out at night.

Where approval has been given to carry out concreting operations at night or in places where daylight is excluded, the Contractor is to provide adequate lighting at all points where mixing, transportation and placing of concrete are in progress.

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**Concreting in High or Low Ambient Temperature**

Where the ambient temperature exceeds thirty two degrees Celsius (32°C), the Contractor shall take special measures in the mixing, placing and curing of concrete. The temperature of the concrete when deposited shall not exceed thirty degrees Celsius (30°C). The Contractor shall carry out all necessary special measures to ensure that the maximum concrete temperature after placing shall not exceed fifty degrees Celsius (50°C) or thirty degrees Celsius (30°C) above the concrete temperature at the time of placing, whichever is lower.

During placing suitable means shall be provided to prevent premature stiffening of the concrete placed in contact with hot surfaces.

The Contractor shall not mix and place concrete when the ambient temperature falls below three degrees Celsius (3°C).

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**Curing and Protection**

Concrete shall be protected during the first stage of hardening from the harmful effects of sunshine, drying winds, cold, rain or running water. The Contractor shall pay particular attention to the need to protect concrete immediately after the finishing operation and prior to its final set and shall submit their proposals.
to achieve this protection for the Engineer’s approval. Protection of concrete which has achieved its final set shall consist of one or more of the following:

(a) A layer of sacking, canvas, hessian, straw mats or similar absorbent material or a layer of sand, kept constantly moist by spraying with water as necessary for fourteen (14) days or such periods as may be directed by the Engineer.

(b) After thoroughly wetting, a layer of approved waterproof paper or plastic membrane kept in contact with the concrete for fourteen (14) days or such period as may be directed by the Engineer.

The use of saline water for curing purposes will not be permitted.

Steel Reinforcement

Materials

Unless otherwise directed or otherwise shown on the Drawings, hot rolled high yield reinforcement shall be used throughout the works.

Where required, mild steel reinforcement, medium tensile steel reinforcement and high tensile steel reinforcement shall comply with BS 4449. Cold twisted steel wire for the reinforcement of concrete shall comply with BS 4482.

All reinforcement shall be sourced from an approved manufacturer and, if required by the Engineer, the Contractor shall submit a test certificate of the rollings. The Contractor shall, when requested by the Engineer, provide sample pieces 1.0 metre long for testing.

Tying wire shall be 1.6 mm diameter soft annealed iron wire.

Before any steel reinforcement is embedded in the concrete any loose mill scale, loose rust and any oil, grease or other deleterious matter shall be removed. Partially set concrete which may adhere to the exposed bars during concreting operations shall likewise be removed.

Fabricating Reinforcement

Bar reinforcements shall be bent to the shapes shown on the Drawings and bending schedules. All bars shall be bent cold, unless otherwise permitted by the Engineer. All hooks, bends, and the like, unless otherwise shown on the Drawings, shall be to BS 8666. The Contractor shall satisfy himself as to the accuracy of any bar bending schedules supplied and shall provide all reinforcement in accordance with the Drawing. Bar reinforcement shall be bundled and each bundle of steel shall be tagged with identifying tags, showing the size and mark of the bar. The bundles shall be stacked clear of the ground in easily accessible positions that do not in any way hinder the progress of work and shall be kept clean.

Fixing Reinforcement

When placed in the work reinforcement shall be free from coatings or dirt, detrimental scale, paint, oil or other foreign substances. When steel has on its surface rust, loose scale and dust which is easily removable, it may be cleaned by a method approved by the Engineer.

All reinforcing bars, ties, links and fabric shall be fixed in the positions shown on the Drawings within the tolerances specified in BS 8666. In no case shall the cover specified on the Drawings be increased by more than 5 millimetres.

Displacement of reinforcement beyond the specified tolerance shall be prevented by supporting the bars sufficiently and securely fixing them together at intersections where necessary.


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The ends of all tying wires shall be turned into the body of the concrete and not allowed to project towards the surfaces of the concrete.

Spacers shall be used to maintain the cover to all steel and shall be made of dense cement mortar of one part cement and two parts sand.

Spacers shall be triangular in section and only one acute edge shall bear against the formwork, the flat side shall bear against the steel. Wire cast into the blocks to fix them to the reinforcement shall be 1.6 millimetres diameter soft annealed iron. Spacers shall not be used on the wet face of water retaining or water excluding structures. Chairs, stools, etc. shall be used to maintain clearance between two or more layers of reinforcement.

Nothing shall be allowed to interfere with the specified position of reinforcement. The fixing of reinforcement shall be checked before and during concreting, and particular attention shall be given to the position of top steel in cantilever sections. During concrete placing a competent steel fixer shall be in attendance to adjust and correct the position of any reinforcement which may be displaced.

**Splicing and Lapping**

All reinforcement shall be provided in full lengths as indicated on the Drawings or bending schedules. Splicing of bars, except where shown on the Drawings, shall not be permitted without the written approval of the Engineer. Splices shall be staggered as far as possible. Bar reinforcement shall not be welded without the Engineer's written permission.

In lapped splices, the bars shall be placed in contact and wired together in such manner as to maintain a clearance between bars of not less than 50 millimetres.

Mesh or bar reinforcement shall overlap sufficiently to maintain a uniform strength and shall be securely fastened at ends and edges. The edge lap shall not be less than 40 diameters of the mesh reinforcement bar or two mesh widths whichever is greater.

**Cover to reinforcement**

The concrete cover to reinforcement shall be 50 mm unless otherwise shown on the Drawings.

The Contractor shall provide any necessary concrete pads for ensuring the cover is attained and in no case shall timber packing be used.

**Formwork**

**Definitions**

Forms, formwork or shuttering shall mean all temporary moulds forming the concrete to the required shape together with any special lining that may be required to produce the concrete finish specified.

False work or centering shall mean the furnishing, placing and removal of all temporary construction such as framing, props and struts required for the support of forms.

**Materials**

The formwork may of seasoned, planed, tongued and grooved timber, plywood, block board, tempered hardboard, steel or as specified on the Drawings.

All timber used for formwork shall be sound wood, well seasoned and free from loose knots, shakes, large checks, warping and other defects. Before use on the work, it shall be properly stacked and protected from
injury from any source. Any timber which becomes badly warped or cracked, prior to the placing of concrete shall be rejected. All formwork for outside surfaces before final ground level shall be either tongued and grooved or provided with a suitable lining to produce a smooth surface finish.

**Forms**

All forms shall be of wood or metal and shall be built grout-tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Forms shall be constructed and maintained so as to prevent warping and the openings of joints due to shrinkage of the timber.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. The design of the forms shall take into account the effect of vibration of concrete as it is placed.

All formwork shall, unless otherwise directed, be provided with 25 millimetres by 25 millimetres angle fillets (chamfers) so as to form splays on internal and external angles.

A grout check formed from 25 millimetres square hardwood timber shall be incorporated in the formwork to provide a clean, level, horizontal joint on exposed concrete surfaces at the top of each lift.

All joints in the formwork shall be either horizontal or vertical. End formwork shall be square across the mass of concrete.

Where concrete is to be deposited to a slope steeper than 20 degrees to the horizontal, top formwork shall be used to enable the concrete to be properly compacted unless the Engineer agrees otherwise.

Openings for the inspection and cleaning of the inside of formwork for walls, piers and columns shall be formed in such a way that they can be closed conveniently before commencing to place concrete.

Form clamps, tie bolts and anchors shall be used to fasten forms. The use of wire ties to hold forms in position during placing of concrete will not be permitted. Tie bolts and clamps shall be positive in action and of sufficient strength and number to prevent spreading or springing of the forms. They shall be of such type that no metal part shall be left within the specified concrete cover. For water retaining sections, methods of fixing the forms which result in holes through the concrete section when the formwork is removed shall not be used and built-in wall ties shall be fitted with water baffles.

All forms for outside surfaces shall be constructed with stiff wales at right angles to the studs and all form clamps shall extend through and fasten such wales.

The shape, strength, rigidity, grout tightness and surface smoothness of forms which are re-used shall be maintained at all times. Any warped, bulged or otherwise damaged timber shall be replaced. Forms which are unsatisfactory shall not be re-used. If the surface finish on the formed concrete deteriorates as a result of deterioration of the faces of the forms, the Engineer shall instruct that forms be resurfaced, or discarded.

All forms shall be treated with approved mould or similar oil or be soaked with water immediately before placing concrete to prevent adherence of concrete. Any materials which adhere to or discolour concrete shall not be used.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods which shall be as specified in Clause 3.34. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the Engineer shall order the work stopped until the defects have been corrected.

All formwork shall be approved by the Engineer before concrete is placed within it. The Contractor shall, if required by the Engineer, provide copies of calculations of the strength and stability of the formwork and false
work. Notwithstanding the Engineer’s approval of these calculations, the Contractor shall be held responsible
for the safety and adequacy of formwork.

**False work and Centering**

Detailed plans for a false work or centering shall be supplied by the contractor to the Engineer at least 14 days
in advance of the time the Contractor begins construction of the false work. Notwithstanding the approval of
the Engineer of any designs for false work submitted by the Contractor, the Contractor shall be solely
responsible for the strength, safety and adequacy of the false work or centering.

All false work shall be designed and constructed to provide the necessary rigidity and to support the loads
from the weight of green concrete and shuttering and incidental construction loads.

False work or centering shall be founded upon a solid footing safe against undermining and protected from
softening. False work which cannot be founded on satisfactory footings shall be supported on piling which
shall be spaced, driven and removed in a manner approved by the Engineer. The Engineer may require the
Contractor to employ screw jacks, or hard wood wedges to take up any settlement in the formwork either
before or during the placing of concrete.

False work shall be set to give the finished structure the required grade and camber shown on the Drawings.

**Forms for Joints**

Where permanent or temporary joints are to be made in horizontal or inclined members, stout stopping off
boards shall be securely fixed across the mould to form a water-tight joint. The form of the permanent joint
shall be as shown on the Drawings.

Where reinforcement or water stops pass through the face of a joint the stopping off board shall be drilled so
that the bars or water stop can pass through, or the board shall be made in sections with a half round
indentation in the joint faces for each bar so that when placed the board is neat and accurate fit and no grout
leaks from the concrete through the bar holes, joints or around the water stop.

**Release Agents**

Only approved chemical release agents, mould creams (emulsions of water in oil) or oils containing a
proportion of surfactant not exceeding 2 percent will be permitted. Water soluble emulsions and oils without
surfactant shall not be used. Oil based release agents shall be applied at a rate of 7 square metres per litre one
day in advance of concreting, preferably by spray or roller. Chemical release agents shall be applied in
accordance with the manufacturer's recommendations.

New timber face work shall be given three coats of release agent before use on the work to ensure uniformity
of porosity on the surface.

On no account shall the release agent come into contact with the reinforcement.

**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 the following Table 3.2, and apply to ambient temperatures higher than 10°C. At lower temperatures
or if cements other than ordinary Portland are involved, the Engineer may instruct longer periods.

**Tender Document**: Maintenance Service Contract for Irrigation Pumps, Generators and
Associated Installations in Country Wide National Public Irrigation Schemes, NIA/T/193/2019-
2020 National Irrigation Authority, Nairobi, Kenya,
Compliance with these requirements shall not relieve the Contractor of his obligation to delay removal of formwork until such removal can be completed without damage to the concrete.

Table 3.2 – Formwork striking time

<table>
<thead>
<tr>
<th>Position of formwork</th>
<th>Striking Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beam sides, walls and columns</td>
<td>1 to 2 days</td>
</tr>
<tr>
<td>Slab soffits - props remain undisturbed</td>
<td>4 days</td>
</tr>
<tr>
<td>Beam soffits - props remain undisturbed</td>
<td>7 days</td>
</tr>
<tr>
<td>Removal of slab props</td>
<td>14 days</td>
</tr>
<tr>
<td>Removal of beam props</td>
<td>21 days</td>
</tr>
</tbody>
</table>

Surface Finishes

General

After removal of the formwork no treatment of any kind other than that required for curing the concrete shall be applied to the concrete faces until after inspection by the Engineer. All honeycombed areas, deformed surfaces or other defective surfaces shall then be repaired at the direction of the Engineer. Immediately following the Engineer's inspection of surface finish, all tie bolt cavities shall be filled with sand cement mortar and the surface left smooth, sound, even and uniform in colour.

Should the finishes surface either as-stuck or after repair exhibit a non uniform colour or texture, the Engineer shall have the right to order that the surface be given a skim coat and then painted.

Formed Surfaces

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.

For warped surfaces, facings shall be built up of laminated splines cut to make a tight surface which shall then be dressed and sanded to the required curvature.

Type F1: This finish is for surfaces against which backfill or further concrete will be placed. Formwork shall consist of sawn boards, sheet metal or any other suitable material which will prevent the loss of grout when the concrete is being placed.

Type F2: 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 Type 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 discoloration and other minor defects shall be remedied by methods agreed by the Engineer.

Type F3: This finish is for surfaces which will be in contact with water flowing at high velocity and for surfaces permanently exposed to view where good appearance and alignment are of 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.
Suitable joints shall be provided between sheets to maintain accurate alignment in the place of the sheets. Unfaced wrought boarding or standard steel panels will not be permitted for Type F3 finish. The Contractor shall ensure that the surface is protected from rust marks, spillages and stains of all kinds.

**Type F4:** This finish is similar to that required for type F3 but is used in places where a first class alignment and a dense surface free from air holes and other defects is required, suitable for the application of decorative finishes, in very high velocity water channels and in other similar circumstances.

### Unformed Surfaces

**Type U1:** This is screed finish for surfaces of roads of foundations, beds, slabs, and structural members to be covered by backfill, subsequent stages of construction, bonded concrete topping or cement mortar beds to receive pavings, and on exposed surfaces of paving where a superior finish is not required. It is also the first stage of Type U2 and U3 finishes. The finishing operations shall consist of levelling and screeding the concrete to produce a uniform, plane or ridged surface, surplus concrete being struck off by a straight edge immediately after compaction.

**Type U2:** This is a floated finish for exposed surfaces where a hard smooth steel trowelled surface is not required. Floating shall be done only after the concrete has hardened sufficiently, and may be by hand or machine. Care should be taken that the concrete is worked no more than is necessary to produce a uniform surface free from float marks.

**Type U3:** This is a hard smooth steel trowelled finish for surfaces exposed to water flowing at high velocity. Trowelling shall not commence until the moisture film has disappeared and the concrete has hardened sufficiently to prevent excess laitance from being worked to the surface. The surface shall be trowelled under firm pressure and left free from trowel marks.

**Type U4:** This finish is similar to Type U3 finish but the permissible tolerances are smaller.

### Surface Tolerances

All parts of concrete surfaces shall be in the positions shown on the Drawings within the tolerances set out in Table 3.3 or Table 3.4.

In cases where the Drawings call for tolerances other than those given in Table 3.3 or Table 3.4, the Drawings shall rule.

Where precast units have been set to a specified tolerance, further adjustments shall be made as necessary to provide 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 3.3 - Surface Tolerances for Formed Surfaces**

<table>
<thead>
<tr>
<th>Type of Finish</th>
<th>Tolerance in Millimetres (See Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>F1</td>
<td>10</td>
</tr>
<tr>
<td>F2</td>
<td>5</td>
</tr>
<tr>
<td>F3</td>
<td>2</td>
</tr>
<tr>
<td>F4</td>
<td>See Note 2</td>
</tr>
</tbody>
</table>

**Note 1:**

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 as indicated by a straight edge 3 metres 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 from the correct position shown on the Drawings.

**Note 2:**

Abrupt irregularities are not permitted in a Type F4 finish. Any residual irregularities which remain after removal of formwork shall be removed by grinding to achieve a transition of 1 in 50 between the surfaces adjacent to the irregularity.

**Table 3.4 - Surface Tolerances for Unformed Surfaces**

<table>
<thead>
<tr>
<th>Type of Finish</th>
<th>Tolerance in Millimetres (See Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
</tr>
<tr>
<td>U1</td>
<td>-</td>
</tr>
<tr>
<td>U2</td>
<td>Nil</td>
</tr>
<tr>
<td>U3</td>
<td>Nil</td>
</tr>
<tr>
<td>U4</td>
<td>Nil</td>
</tr>
</tbody>
</table>

**Notes:**

D is the maximum allowable value of any sudden change of level in the surface.

E is the maximum allowable value of any gradual irregularity of the surface, as indicated by the gap between the surface and a 3 metres long straight edge or correctly shaped template placed on the surface.

F is the maximum allowable value of the difference in level or position between a straight edge or correctly shaped template placed on the surface and the specified level or position of that surface.

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**Conduits, Box-outs and Apertures**

The layout of conduits, box-outs, grooves, apertures and the like shall be as shown on the Drawings or as directed by the Engineer, and shall be subject to inspection and approval by the Engineer before commencing concreting.

Conduits shall be placed as near the centres of members as possible and sufficient space shall be provided between adjacent conduits to prevent difficulties in the placing of concrete.

Box-outs, holes grooves, apertures and the like shall be accurately set out in the formwork prior to placing the concrete. Fixing blocks, ends of brackets, bolts and, where possible, built in parts shall be cast into the concrete at the time of placing. No part of the concrete works shall be cut out for any such item, or for any other reason, without the Engineer's permission.

The Contractor shall ensure that all sub-contractors are informed of his programme for the structural works at the commencement of the Contract and that such sub-contractor's requirements relating to concrete members are approved well in advance. The Contractor shall obtain from all such sub-contractors complete information of their requirements regarding conduits, pipes, fixing blocks, ducts, holes and any other items to be cast into or formed in the concrete members. Failure of a sub-contractor to sub-contractor to supply such information shall not be allowed to delay the progress of the Works.

**Construction joints**

Concreting shall be carried out continuously up to construction joints, the position and arrangement of which shall be as indicated on the Drawings or as previously approved by the Engineer. The Contractor is to allow for working beyond the ordinary working hours where necessary in order that each section of concrete may be completed without any lapse while the work is in hand. All construction joints are to be formed square to the work.

Where vertical construction joints are required, the joint face of the first stage concrete shall be finished against a stopping-off board, or vertical end shutter, suitably notched to pass the reinforcement. When the concrete is hard and the shutter is removed, the whole joint surface shall be thoroughly hacked and roughened or scabbled with suitable tools so that no smooth skin of concrete is visible and that all aggregates and solid matrix around them is exposed.

For horizontal or slightly inclined construction joints, the surfaces shall preferably be prepared when the concrete has set but not hardened by jetting with a fine spray of water and brushing with a stiff brush to remove the smooth skin and expose the aggregate without disturbing it. Where this treatment is impractical and work is resumed after the concrete surface has hardened, a similar procedure shall be adopted as on vertical joints.

If, in the opinion of the Engineer, any deleterious material has come into contact with the concrete of the construction joint or if the concrete is honeycombed or unsound for any reason, the concrete shall be cut back to such a depth as the Engineer shall order and the roughened surfaces shall be thoroughly cleaned by compressed air and water jets or other approved means.

Immediately before concreting is resumed, the roughened joint surface shall be thoroughly cleaned with compressed air and water jets and slightly wetted and cement grout placed. The Contractor shall take precaution to avoid segregation of the concrete along the joint plane and to obtain thorough compaction.

**Movement joints**

Movement joints shall be formed in the position and manner shown on the Contract Drawings or instructed by the Engineer. In the case of water retaining structures, joints shall be made water-tight by the provision of a continuous water stop, with suitable water resistant filler material and sealant. The materials and workmanship utilised in movement joints shall comply with the following:

(a) Compressible filler shall be self-expanding cork filler consisting of cork granules bonded together with an insoluble, synthetic resin. When subject to wet or moist conditions the filler shall be capable of swelling to occupy a larger volume than that of the material supplied. The expansion properties of the filler shall not be less than one hundred and forty per cent (140%) when immersed in boiling water for one hour (1hr). The filler shall be supplied and stored in sealed moisture resistant wrappings. Compressible filler shall be secured to the first cast concrete surface using an approved adhesive.

(b) Water stops, either centrally or externally placed, shall be Polyvinyl Chloride (PVC) of the dimensions and type shown on the Drawings. PVC water stops shall have an elongation of at least 300% at rupture with a tensile strength of more than 12.3 N/mm². Gluing temperature shall be about 150°C. The PVC water stop shall accommodate a transverse movement of at least 50 mm. For expansion joints the water stops shall incorporate a centre bulb or box to allow movement to be accommodated. Centrally placed water stops shall have reinforced eyelets on the outer flange to facilitate the positioning of the water stops by wiring to the surrounded steelwork. Externally placed
water stops shall include a wide reinforced nailing flange for positive fixing to formwork or adjacent concrete faces.

Water stops shall be firmly supported by split stop-end shuttering where appropriate, and in no case shall the water stops be pierced to assist in fixing. Special care should be taken to ensure that the concrete is well worked against the embedded part of the water stops and is free from honeycombing. Precautions shall be taken to protect any projecting portions of the water stops from damage during the progress of the work and from sunlight and heat. Where water stops are required to be jointed, this shall be undertaken using approved heat welding equipment. The water stops shall be installed in accordance with the manufacturer's instructions and to the approval of the Engineer.
(c) Joint sealant shall be bitumen-rubber sealing compounds and shall be pourable and in accordance with BS 2499 for horizontal joints and shall be an approved solvent type gun grade applied by suitable for vertical joints.

(d) Miscellaneous materials necessary for the installation of movement joints such as adhesives for securing filler materials, bond breaking tapes, bituminous paints for creating a discontinuity between concrete surfaces and primers shall be compatible with the compressible filler, water stops and sealant specified previously.

Contraction joints where specified shall be formed in the position and manner shown on the Drawings. The reinforcement shall be discontinuous across the joint. Dowel bars, water stops and sealant shall be provided as shown. The face of the first stage concrete shall be finished fair faced and after curing painted with two coats of bituminous paint. Casting of water stops and sealing of joints is to be carried out in accordance with the manufacturer's instructions. Dowel bars shall be round mild steel of the dimensions shown on the Drawings. The bars shall be cast into the first stage concrete and the protruding part shall be painted with two coats of bituminous paint.

Expansion joints where specified shall be formed in the position and manner shown on the Drawings. The reinforcement shall be discontinuous across the joint. Dowel bars, water stops, compressible filler and sealant shall be provided as shown. The face of the first stage concrete shall be finished fair faced and after curing the compressible filler shall be fixed in position in a manner to the approval of the Engineer. Casting in of water stops and sealing of joints is to be carried out in accordance with the manufacturer's instructions. Dowel bars shall be round mild steel of the dimensions shown on the drawings. The bars shall be cast into the first stage concrete and the protruding part shall be painted with two coats of bituminous paint. An end cap shall be fixed to the end of each bar prior to pouring the second stage concrete, in order to create a void at the end of the bar to accommodate any movement.

Pre-cast Concrete Units

Pre-cast concrete units shall be provided by an approved specialist supplier or may, subject to the Engineer's written approval, be manufactured by the Contractor. The Engineer may require the Contractor to supply samples of pre-cast concrete units for testing prior to the approval of the proposed supply for each type of unit and such samples shall be supplied and tested as directed by the Engineer.

Pre-cast concrete units shall be made in accordance with the provisions of this Specification covering concrete work. Pre-cast concrete units shall be manufactured under shed roofs and protected from the weather. The units shall remain in the moulds for seven days and shall remain protected for a further seven days, during which periods the concrete shall be shielded by sacking or other approved material which shall be kept wet. The units shall then be moved from the sheds and stacked in the open for at least a further seven days to season before being set in position.

Pre-cast concrete work shall be tested as directed by the Engineer and work failing to meet the requirements of the Specification shall be rejected. Pre-cast units that become damaged during handling shall likewise be rejected.

The Contractor shall, when required, make arrangements with his supplier for access to the supplier's work for the Engineer to inspect and carry out tests on pre-cast concrete units.

All pre-cast units shall be marked with individual identification. Lifting hooks are to be attached only to those positions shown on the Drawings or detailed by the Engineer. The Contractor shall be deemed to have included in their rates for all measures required to handle and stack units safely and without undue stressing.
Breaking out Existing Concrete or Block work

Well in advance of the commencement of the work the Contractor shall seek the approval of the Engineer regarding the proposed method of breaking out existing concrete or block work in the positions shown on the Drawings or as directed by the Engineer.

Cement Grout

Cement grout for general purposes shall consist of Portland cement and water mixed in the proportion of one (1) part by volume of cement and one and a half (1.5) parts by volume of water. The grout shall be used within one hour (1hr) of mixing.

Cement Mortar

Cement mortar shall be machine mixed and unless otherwise specified, consist of three (3) parts of sand to one (1) part of Ordinary Portland cement mixed and thoroughly incorporated together. Just enough water will be added to give a workability appropriate to its use. The above proportions are by volume. Mortar shall be used whilst freshly mixed and no softening or re-tempering will be allowed.

Concrete Block and Bricks Masonry

Concrete blocks and bricks shall comply with BS 6073: Part 1 and shall have a minimum 28 days compressive strength of 3.5 N/mm² and 7 N/mm² respectively. The concrete blocks and bricks shall be laid in a staggered pattern such that the vertical joints between two consecutive layers are offset by half a block length. Joints on the inside faces shall be rendered in which case the joints shall be raked out at a depth of 5 mm. Rendering shall consist of 1:2 mortar applied to a thickness so as to ensure professional finish.

The mix used to manufacture concrete blocks shall not be leaner than 1:9 by volume and the maximum size of aggregate shall be 10mm. The standard size of the concrete block shall be 400 mm x 200 x 200 mm and 300 x 100 x 100 for bricks. However blocks and bricks of other sizes may be used if approved by the Engineer for proper bonding at corners and openings.

The concrete blocks and bricks shall be wetted before laying and shall be set in mortar, which complies with the specifications given in Clause 3.42. Unless otherwise stated, the maximum joint thickness shall be 12 mm and the horizontal and vertical joints shall be filled with mortar. Joints shall be finished flush with the face of the blocks and bricks. The Concrete block and brick masonry shall be cured for a period of seven days by covering the work with two layers of Hessian, which is kept permanently saturated. Provision shall be made to clean all exposed faces both as the work proceeds and on completion so that they are left in a neat, tidy and clean condition.

Building masonry will not be permitted in heavy rain without the approval of the Engineer. In such instances the Contractor shall make provision to protect materials and the newly placed mortar from the rain.
Concrete blocks shall either be obtained from an approved manufacture or made on site in approved block making machines. When casting of the concrete blocks is done at site, these shall be removed from the casting machine and deposited on edge on covered racks and left for 3 days, during which time they shall be kept constantly wet. Afterwards they may be placed on racks in the open provided they are protected by Hessian cloth or similar and kept wet for a further 5 days. Thereafter they shall not be moved or used in the works until they are 28 days old.

Chambers shall be constructed after pipes have been laid, except the bases may be constructed earlier to avoid deterioration of the formation.

Backfilling around completed chambers shall be with suitable material deposited equally all round and compacted in accordance with the Specifications.

Where any pipes are built into concrete or block work the pipe shall be surrounded in two layers of polythene sheeting unless a puddle flange has been shown on the Drawings.

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**Rendering Work**

---

**Material**

Cement, water and fine aggregate shall conform to the requirements specified in the concrete works. Mesh reinforcement shall be plain diamond expanded steel lathing to BS 1369 where specified. Lime shall be to BS 980 and shall be mixed with water and allowed to stand prior to use according to the manufacturer’s recommendations.

The mix proportion of the cement mortar by volume shall be as follows:

- For rendering coat, Cement : Sand = 1:5
- For finishing coat, Cement : Sand = 1:3

Lime putty may be mixed in mortar for finishing coat at 10% of sand by volume.

**Waterproof cement mortar**

Waterproof mortar shall be made by mixing a waterproof agent into ordinary cement mortar. The Contractor shall be responsible for selection and quality of the waterproof agent and this shall be approved by the Engineer before use. The mixing and application shall be in accordance with the manufacturer’s instructions.

**Application**

The surfaces which are to receive a rendering coat shall be free from all laitance, scum, loose carbonate scale, loose aggregate dirt and other foreign matters. Concrete block, brick or stone surfaces shall be sufficiently and uniformly damped immediately before application of mortar. Concrete surfaces shall be kept thoroughly wet for 24 hours prior to the application of mortar.

Where shown on the drawings or directed by the Engineer, steel wire lath shall be fixed to the brick, concrete block or concrete walls before applying cement mortar plaster.

Cement mortar shall be used within 30 minutes from the time of mixing. Re-tempering shall not be permitted.
The total thickness of rendering plus finishing coat shall be 30 mm for the floors and 20 mm for wall. Cement mortar finish shall be trowel finished unless otherwise specified. When the finishing coat is applied, the entire surface of floor or wall shall be finished in one operation in order to minimise joint marks. When expansion and control joints exist in the base structure, provision shall be made to prevent cracking of the mortar by inserting metal expansion beads within the coating thickness in a manner approved by the Engineer.

The finished surface shall be perfectly plumb or level as the case may be except where otherwise specified without any bulging, runs, bruises or stains.

After application of the finishing coat, the surfaces shall be kept continuously damp for not less than 48 hours and then allowed to become thoroughly dry. Moistening shall be started as soon as the surface has hardened sufficiently not to cause displacement or damage.

In Situ Concrete Chambers

In situ concrete chambers shall be constructed generally in accordance with Section 3 of this Specification.

Chamber Covers and Slabs

Covers and slabs shall be the type, size and weight shown in the drawings. Care shall be taken to see that slabs are even so that the cover can seat without rocking.

Covers and frames shall be provided as shown on the drawings. The tops of the covers shall be flush at all points with the surrounding surface of paved areas or as directed in unpaved areas. Any slight adjustment of the slab level which may be necessary to accomplish this shall be effected by topping the side walls with concrete.

STONEWORK

Stones

Stone for all purposes shall be the best of its kind, sound and durable, free from flaws and from soft, weathered or decomposed parts. The stone and the quarry from which it is obtained shall be subject to the approval of the Engineer, samples shall be submitted by the Contractor of the stone he proposes to use in the Works and the Engineer's approval shall be obtained before such stone is used or any order is placed. The stone used shall be clean and must be washed if deemed necessary in the opinion of the Engineer.

Stones for face work shall be as far as possible quarry split and not bullnosed or hammer dressed. A moderate amount of dressing to trim off large projections will however be permitted. Exposed faces of stones for masonry shall be free from tool marks except such as are inherent in the nature of any dressing that may be specified. In rock-faced work the roughness on the surface shall not project more than 40 mm for stone less than 0.3 m² face area and not more than 60 mm for large stones.
Stone Masonry

Masonry shall be built to the lines and levels shown on the Drawings.

For face work the stones shall show a face of not less than 0.025 m\(^2\) and not more than 0.1 m\(^2\) in area and none shall be less than 100 mm in depth; they shall be laid to give a uniformly random appearance and shall be selected in laying so as to present an even distribution of large and small stones on the face.

For the arises, stones shall be roughly squared, quarry split and of a size to give out bands varying from 300 mm to 500 mm in length and in bands from 150 mm to 250 mm. The alignment of arises shall be set true to the required lines.

The stones shall be set in mortar with their natural bedding plane (if any) as near normal as possible to the face or normal to the line of thrust in the case of load bearing structures. Particular care must be given to obtaining a sound bond both longitudinally and transversely and there shall be at least one bonder, or length not less than two-thirds of the wall thickness, in each square yard of wall face.

The mortar, unless otherwise specified, shall be machine mixed cement and sand in the proportion of one part to three (1:3) parts generally as described in the specification. Mortar shall completely fill all interstices between the stones.

The face joints in rubble masonry may vary in thickness from 10 mm to 20 mm. They shall be finished as a neat weathered joint with mortar while the work proceeds where the masonry is specified to be "unpointed". Where pointing is specified, the joints in each day's work shall be raked out to a depth of not less than 25 mm before the mortar has set. Subsequently the joint shall be filled with mortar and finished in accordance with Clause 4.6. The face of the masonry is to be kept wet while the pointing is proceeding. Provision shall be made to clean all exposed faces both as work proceeds and on completion so that they are left in a neat, tidy and clean condition.

Building of masonry will not be allowed in heavy rain without the written consent of the Engineer. Building shall only proceed when suitable precautions to the satisfaction of the Engineer shall be taken against the action of rain on newly placed mortar. If for any reason of urgency the consent of the Engineer should be desired to a departure from these provisions, the Contractor shall submit to the Engineer for approval their proposals for protecting the materials and work from the weather.

Types of Masonry

The arrangement of the stones on the exposed face or faces of the masonry shall be as described below according to which type is called for on the Drawings.

(a) Random rubble uncoursed masonry shall be built with stones of irregular shapes taken generally as they come from the quarry, preparation being limited to the removal of inconvenient corners and excrescences. They shall be selected as the work proceeds to give a uniformly random appearance and no attempt shall be made to form courses.

(b) Random rubble masonry brought to courses shall be generally as the preceding type except that it shall be levelled up to courses between 300 mm to 400 mm in depth and coinciding with the quoin stones.

(c) Squared rubble coursed masonry shall be built in courses between 100 mm to 250 mm in depth of stones squared to rectangular shapes and selected so that all stones in one course are of approximately the same height.

Bedding of Stone Masonry

Unless otherwise directed by the Engineer, all masonry stones, when incorporated in the Works shall be laid on its natural bed, except in the case of arches where the natural bed shall be radial.

Special Stonework

Special stonework shall consist of approved stones dressed to the shapes and dimensions and with the faces tooled, all as shown on the Drawings. All stones shall be laid true to line and centre with mortar joints as shown on the Drawings.

Pointing of Joints in Masonry

Unless otherwise shown on the Drawings, pointing to masonry joints shall be flush and shall be formed by raking the joint clean and then filling it with pointing consistency mortar which shall be given a flush face with a steel trowel.

Hand Placed Rubble Filling

Hand placed rubble filling shall consist of stones individually selected and placed by hand firmly in place in bearing contact with each other or with the sides of the space to be filled; the voids shall be carefully filled with small rocks and spalls wedged together to form a compact mass. The sides of stones shall be roughly trimmed if necessary with a spalling hammer to obtain a reasonably close fit. On the exposed face the stones shall be placed with their flattened sides uppermost and in the plane of the face.

Tipped Rock / Pitching

Rock protection on embankment slopes and around structures shall be to the lines and levels shown on the contract Drawings. The terms "tipped rock" and "pitching" refer to the manner in which the rock is placed.

The different classes of rock are specified on the Drawings according to nominal size and the maximum and minimum size of the individual particles. Within the size limits of each class, the rock fragments shall be well graded with not more than forty per cent (40%) of the rocks being smaller than the stated nominal size. The shape of the rock shall be roughly uniform with no dimension less than sixty percent (60%) of the largest dimension. The individual rock pieces shall be dense, durable and abrasion resistant.

The Contractor shall submit bulk samples of not less than 2 m$^3$ of each class of rock for approval by the Engineer prior to placing. These samples shall be retained for comparison with material being placed in order to ensure a reasonable degree of uniformity within each class.
The base on which rock protection is to be placed shall be compacted and trimmed to the lines and levels shown on the drawings. Where two or more classes of rock are specified, the lower layers shall be completed to the Engineer's approval before the placing of subsequent layers.

Tipped Rock shall be tipped directly into place and roughly trimmed to the required profile. The thickness, lines and levels of each class of tipped rock is shown on the Drawings.

Pitching will be used where a finished horizontal or inclined surface is required. It shall consist of hand placed stones, with spalls wedged into the interstices to produce an even surface, without projection above the neat lines shown on the Drawings. Care shall be taken to ensure that the stones are well bedded and the percentage of spalls shall not exceed forty percent (40%) of the total rock volume. Pitching on slopes shall be built upwards from the toe, unless otherwise directed by the Engineer. A coping consisting of large flat stones shall be laid along the top of stone pitching on slopes to produce a firm edge.

Tipped Rock and Stone Pitching shall consist of selected hard durable rock free from weathered or decomposed parts to the approval of the Engineer, containing no flaky stone and being well graded within the limits shown below. The class and the thickness of the layer shall be as shown on the drawings.

<table>
<thead>
<tr>
<th>Class</th>
<th>Size of stone d (mm)</th>
<th>Percentage by weight smaller than stone sized</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>40-55</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>40-55</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>63</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>60-85</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>20-40</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>31.5</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>50-80</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>20-50</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>350</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>225</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>35-55</td>
</tr>
<tr>
<td></td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>850</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>30-60</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>0</td>
</tr>
</tbody>
</table>

Tipped rock / stone pitching shall be placed in an approved manner in order to produce a uniform well knit un-segregated layer in which all sized are held in position.
Gabions

Gabions shall be of the types and sizes shown on the Drawings. The cages shall be constructed from mild steel wire complying with BS 1052, "Specification for mild steel wire for general engineering purposes", galvanised in accordance with BS 443, "Specification for testing zinc coatings on steel wire and for quality requirements". The wire shall be 3mm diameter formed into a fabric having a mesh of 75 mm x 100 mm for baskets and 60 mm x 80 mm for mattresses.

Stone filling for gabions shall consist of hard durable rock, free from weathered or decomposed parts. The minimum dimensions of each stone shall not be less than half its maximum dimension. For mattresses the stone shall be 200 mm to 150 mm for baskets the stone shall be 300 mm to 200 mm. The stone shall be obtained from a source approved by the Engineer. No stone shall be smaller than the size of the gabion mesh. In carrying out the filling, selected pieces of stone of elongated shape shall be placed with their flatter and elongated faces in contact with the mesh wherever possible.

The empty gabions shall be placed to line and level as shown on the Drawings or as directed by the Engineer and then stretched so that the gabions regain their shape on being filled. Diaphragms shall be provided at not more than 1m intervals for baskets and not more than 0.6 m intervals for mattresses. A gabion shall not be completely filled until the adjacent basket or mattress has been half filled, unless otherwise directed, in order not to cause displacements from bulging during filling.

For baskets at least two horizontal connection wires shall be tied between front and back of the gabion in each 1m compartment, at a height of 300 mm and 600 mm from the bottom as the stone fill reaches these levels. Additional tie wires shall be provided if necessary and in no case shall the gabion basket bulge by more than 40 mm. Where a continuous line of gabions is required, adjacent gabions shall be securely tied together at the top and bottom of the gabions with tying wire.

The gabions shall be filled to a level just sufficient to require the lid to be forced into place with a bar. The lid and all joints between baskets and between diaphragms and baskets shall each be tied down with a continuous running wire.

Where gabions are to be shaped, the shape shall be formed by folding the mesh internally and tying it with a continuous running wire.

All tying wire shall be galvanised and of same gauge as specified for the cages above.

The surface upon which gabions are to be laid shall be compacted to a minimum dry density of 95% of the maximum dry density (AASHTO T99).

Geotextile Filter Cloth

Geotextile filter cloth shall be made of non-woven polyester material with a minimum weight of 270 g/m² and minimum thickness of 2.3mm.

The material shall be placed carefully on suitably cleared surfaces, such that tearing or piercing is avoided at all times.

Continuity at horizontal and vertical joins shall be achieved with a minimum overlap of 0.6m. Overlaps may be physically sealed using spot welds with an open flame and subject to approval of the Engineer. On a horizontal join, the new layer shall be placed on the outside and backfilling shall proceed carefully to ensure that full contact of the join overlap is maintained. On a vertical join, the new layer shall be placed on
the inside, and backfilling shall proceed such that contact is first on the outside layer, thereby sealing the inside layer to prevent soil migration between the overlap.

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**Graded Filters**

The filter shall consist of well graded natural or manufactured aggregate having the following gradation. In the following ratios, FM represents the filter material and BM the base material.

For graded filters of sub-rounded particles:

\[
50\% \text{ size FM} \quad R_{50} = \frac{1}{228} \quad = 12 \text{ to } 58
\]

\[
50\% \text{ size BM}
\]

and

\[
15\% \text{ size FM} \quad R_{15} = \frac{1}{228} \quad = 12 \text{ to } 40
\]

\[
15\% \text{ size BM}
\]

For graded filters of angular particles:

\[
50\% \text{ size FM} \quad R_{50} = \frac{1}{228} \quad = 9 \text{ to } 30
\]

\[
50\% \text{ size BM}
\]

and

\[
15\% \text{ size FM} \quad R_{15} = \frac{1}{228} \quad = 6 \text{ to } 18
\]

\[
15\% \text{ size BM}
\]

The filter material should pass a 75mm for minimising particle segregation and bridging during placement. Also the filter must not have more than five per cent (5%) of material finer than that passing a 60 micron sieve to prevent movement of fines within the filter.

The graded filters shall consist of stone graded to meet the requirements indicated below.

<table>
<thead>
<tr>
<th>Class</th>
<th>Size of particles d (mm)</th>
<th>Percentage smaller than particle size</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>63</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>70-100</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>10-80</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0-25</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>64-100</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>15-64</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>0-15</td>
</tr>
<tr>
<td></td>
<td>0.09</td>
<td>0</td>
</tr>
</tbody>
</table>

The filter shall be placed in layers and tamped into place in such a manner that mixing between layers or between the filter material and the formation to be protected, shall not occur.

Care shall be taken to ensure that segregation of sizes does not occur. The minimum thickness of each filter layer shall be 250 mm unless otherwise shown on the Drawings. Where the term “gravel backing” is used on the drawings or Bills of Quantities, this shall be taken to mean graded filter Class A material.

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**Hardcore**

Hardcore shall consist of broken rock, concrete or other approved hard material, clean and free from extraneous matter, having a maximum particle size of 100 mm. It shall be spread and levelled, watered and compacted, and then blinded with a layer of fine material of grading 3 mm to dust, watered and compacted all to the Engineer’s approval.

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**PIPEWORK**

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**General**

The Contractor shall construct pipelines to the lines and levels using grades, classes, or designs of pipe, bedding, haunching and surrounding as shown on the Drawings or directed by the Engineer.

Unless otherwise described in the Contract or agreed by the Engineer only one type of pipe shall be used within any individual length.

All materials shall be subject to the approval of the Engineer prior to procurement and delivery. Upon delivery, the Engineer shall inspect the delivered material for compliance with the specifications. In case of non-conformity, the Contractor shall replace the material at his own cost.

The pipes and fittings shall comply in all respects with British Standards and jointing of pipes and fittings shall be carried out in accordance with the manufacturers’ instructions and to the approval of the Engineer.

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**Storage and Protection of Materials**

Pipes shall be stacked on a firm base using two timber packers only under the barrel of rigid pipes such as concrete or steel.

Flexible pipes such as uPVC shall be stacked closely side by side on a firm plane base so that the whole length of the barrel is uniformly supported and sockets are clear of the ground. Each succeeding layer shall be placed at right angles to the previous layers. The height of any stack shall be not more than six layers of pipes and in the case of steel, not more than two layers.

Fittings and specials of any type shall be stored in a single layer only.

Pipes and fittings shall at all times be adequately protected from damage during transport, storage and handling. Cracked or chipped pipes shall not be used in the permanent works. Steel and large diameter plastic pipes shall be fitted in the factory with end caps or reinforcement adequate to prevent distortion during transport, storage and handling.

Plastic pipes and fittings shall be protected from direct sunshine and excessive heat. Deformed pipes and fittings shall not be used in the permanent works.
Rubber rings and other pipe jointing material shall be stored under cover from direct sunshine.

Granular bedding shall be stored on a firm impermeable base so that it does not become contaminated with deleterious matter.

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Handling Pipes and Fittings

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Before any pipes are delivered to site the Contractor shall submit details to the Engineer of his proposals for handling pipes during transport, in store and during laying.

During transport and in store, pipes shall not rest on narrow traverse supports likely to cause damage to the pipe or its coating. Pipes shall not be unloaded from a vehicle by tipping or dropping.

Pipes shall be lifted by flat braided wire slings or band slings except in the case of externally coated pipes and plastic pipes for which band slings having a width of at least 300 mm shall be used. Wire rope sling shall not be used for any pipes. No pipes shall be lifted by means of hooks applied to the ends of the pipe or by means of appliances such as grabs and togs.

In making arrangements for handling pipes, the Contractor shall take into account any recommendations made by the pipe manufacturer.

Where appropriate the requirements of this Clause shall apply to fittings and other components.

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Cutting Pipes

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The cutting of pipes for making up lengths shall be carried out by a method which leaves a clean square end.

Concrete pipes shall be cut with a concrete saw or by hand. If cut by hand the end of the pipes shall be trimmed even and square and if reinforced, the steel shall be cut flush with the face of the concrete. If instructed by the Engineer the exposed ends of the steel shall be protected with bitumen or a cement grout.

Steel pipes to be cut shall have the line to be cut clearly marked round the pipe. Cutting shall be carried out by cutting disc or by oxy-acetylene and the cut end shall subsequently be ground to the correct profile for the method of jointing in use.

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Pipes and Fittings

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Concrete Pipes

Concrete pipes shall comply with BS 5911 "Specification for concrete cylindrical pipes, bends, junctions and manholes, un-reinforced or reinforced with steel cages or hoops" save that the crushing test loads for the various diameters of pipe shall be as shown in Table 5.1:

Table 5.1 Crushing test loads

### Nominal size of pipe (mm) | Works proof load KN/m effective length
---|---
300 | 23 (Class M equivalent)
450 | 35 (Class M equivalent)
600 | 46 (Class M equivalent)
800 | 54 (Class M equivalent)
900 | 85 (Class M equivalent)
1000 | 73 (Class M equivalent)
1200 | 110 (Class M equivalent)
1500 | 132 (Class M equivalent)

Works proof loads shall be 80% of the maximum loads for each size of pipe.

Damaged pipes showing signs of visible cracking either on the inside or outside surface shall not be used.

**Steel pipes**

Steel pipes and specials for water and sewerage shall comply with BS 534.

Galvanised mild steel pipes and fittings shall comply with BS 1387 Class B or "Medium Grade" and complying with ISO 65. Threading for screwed and socketed joints shall be in accordance with the requirements of BS 21.

Joints shall be made with an approved pipe-jointing compound in accordance with the manufacturer's instructions. Red lead compounds shall not be used. Joints in underground piping shall be coated with bitumen or other approved composition.

All underground sections of pipework to be protected against corrosion by treating with "COLAS primer, and wrapped with fibreglass and coated with two coats of 'COLAS' bituminous tap coats all to manufacturers specification.

The bituminous paint is to be manufactured to ASTM D1187-82.

All fittings for galvanised steel water pipework shall be galvanised heavy weight fittings in accordance with BS 1740, BS 5153 and BS 5154. All fittings shall be subject to the approval of the Engineer.

Brass or gunmetal fittings shall be subject to the approval of the Engineer.

**uPVC pipes**

Un-plasticized Polyvinyl Chloride (uPVC) pressure pipe shall have outside diameters complying with ISO 161, laying lengths complying with ISO 264 and wall thicknesses complying with ISO 4065. The uPVC pipes shall comply with BS 3505 Class C (0.9 bar working pressure). Joints shall be of the spigot and integral socket type. Solvent weld joints are not permitted in buried uPVC pipelines.

Fittings for use with uPVC pressure pipe shall be manufactured from either uPVC or cast iron with socketed joints and shall comply with ISO 727. Cast iron fittings shall be bitumen coated. Aluminium alloy fittings are not permitted.

The metal adaptor fittings shall comply with ISO 4132.

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**Valves**
Gate valves

Gate valves shall conform to BS 5153 for cast iron and BS 5154 for copper alloy “valves for general purposes”.

All gate valves shall close in a clockwise direction and the direction of opening and closing shall be cast on the hand wheels or valve casing with the words ‘OPEN’ and ‘CLOSE’ respectively. All gate valves shall be capable of being operated manually with a maximum applied torque of 100 Nm for valves with a nominal diameter less than 450mm. The Contractor shall ensure that the gate valves supplied are fitted with appropriate thrust bearing guides and gearing to fulfil these requirements, ensuring that when reduction gearing is employed, the gear ratio shall not exceed 4:1.

Isolating gate valves shall permit manual closing off of the raw water supply.

Butterfly valves

Butterfly valves shall conform to BS 5155 “Specification for butterfly valves”. The use of butterfly valves as main line valves shall not be permitted.

Check valves

Check valves shall conform to BS 5153 for cast iron and BS 5154 for copper alloy “check valves for general purposes”.

The valves shall be installed in a horizontal position to avoid malfunctioning of the check.

Float ball valves

Float operated valves shall comply with BS 1212 and BS 1968 and BS 2456 “specifications for float ball valves”.

Ball valves shall be the plastic diaphragm type or similar approved with seatings to suit the working pressure of 5 bars with plastic float to BS 2456 and internal overflow.

Painting of valves

All valves shall be painted internally and externally to give the same standard of protection as for steel pipes and fittings. Surface protection shall be all to the approval of the Engineer.

Laying Pipes in Trenches and Headings

Immediately before pipes are placed in any trench, the bottom shall be cleared of all stones and other debris and shall be in a condition acceptable to the Engineer. Prior to placing in the trench, all pipes shall be inspected for damage. Damaged pipes which in the opinion of the Engineer cannot satisfactorily be made good shall not be used in the permanent works. End caps or discs placed on the pipes for protection during transit shall not be removed until immediately before the pipes are jointed.

Pipes shall be laid in straight lines unless otherwise shown on the drawings. No pipe shall deviate from the true line and level by more than 5 mm. Pipes shall be firmly bedded throughout their length to the required alignment and level so that they are concentric at each joint. All pipes shall be suitably wedged, shored or otherwise restrained to prevent movement during testing and backfilling but such restraints shall not be left in place permanently unless instructed or agreed by the Engineer.
Pipes which are to receive a concrete bed and haunch or surround shall be sent on suitable concrete blocks or bricks with a pad of Hessian based damp proof course two millimetres thick interposed between the pipe and the block. Setting blocks shall not be used with other forms of bedding.

Unless otherwise agreed by the Engineer a close fitting brush or swap shall be placed in pipelines having nominal diameters of 650 mm or less and shall be drawn forward progressively as pipe laying proceeds by means of a suitable rope which shall be threaded through each pipe as it is laid. Pipelines having nominal diameters greater than 650 mm shall be kept clean by suitable means as pipe laying proceeds. No debris of any kind shall be allowed to remain in the pipeline. Where the pipeline has internal lining, persons entering shall wear rubber boots and equipment trolleys shall have rubber tyred wheels. Pipes and joints shall be kept free of dirt, mud and other deleterious matter at all times. If pipe laying is stopped at any time, a cap shall immediately be placed on the end of the last pipe laid to exclude dirt.

Suitable precautions shall be taken to prevent the floating of pipes due to flooding of trenches. If floating should occur, the whole of the pipe run affected shall be removed and trench prepared again. No pipes shall be re-laid in trenches which have flooded until the trenches and the pipes have been inspected by the Engineer. The Contractor shall be entirely responsible for the sufficiency of all temporary supports and side slopes to the excavations. The excavation shall be carried out in such a way as to maintain the stability of all roads and other adjacent structures or works.

Pipes having integral sockets shall be laid with sockets facing upstream unless otherwise agreed or instructed by the Engineer.

Pipes in headings shall be laid in accordance with the requirements of this clause but pipe lengths shall not exceed 1.5 m unless otherwise agreed by the Engineer.

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**Pipes Laid on Natural Ground**

Filling shall commence with selected fill consisting of easily compacted material from which all stones larger than 25 mm and all lumps of clay larger than 75 mm have been removed. The selected fill shall be deposited equally on each side of the pipe carefully compacted in layers not more than 150 mm thick. Care shall be taken to ensure that no voids are left under the pipe. The filling shall be continued to a level of 300 mm above the crown of the pipe.

In the case of steel, ductile iron and plastic pipes, the Contractor shall ensure that no distortion of the pipe takes place during the backfilling operation.

The remainder of the trench shall be filled with excavated material and compacted in 150 mm thick layers by means of a vibrating plate compactor or a mechanical rammer. The trench shall be filled flush with the surrounding ground surface.

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**Pipes laid on Granular Bedding**

Granular bedding material shall be placed and compacted generally on both sides of the pipe up to the horizontal diameter of the pipe. Care shall be taken to ensure that no voids are left under the pipe. Thereafter the selected fill shall be as described in Clause 5.8 above.
Pipes with Concrete Bedding and Surround

The configuration of the concrete bedding, surround or arch shall be as shown on the drawings including the location of reinforcement if any is required. Pipes to be set in concrete shall be supported as set out in Clause 5.7. Small diameter pipes in short lengths shall be supported behind pipe socket. Large diameter pipes and long lengths shall be supported on two packers.

After jointing and testing as set out in the appropriate parts of this section, concrete of the class shown on the drawings shall be carefully placed and compacted under the pipes making sure that no voids are left, and brought up to the configuration shown on the drawings. The Contractor shall ensure that the pipes do not float or are in any way disturbed during concrete placing. The remainder of the backfill shall be placed as set out in Section 2 of this Specification.

Where pipes, which are laid on a bed of granular material, are to be protected by a concrete arch, the laying and jointing shall proceed as set out in the appropriate parts of the Specification and granular material shall be brought up to the horizontal diameters of the pipes.

After testing, concrete shall be placed over the pipes to the configuration shown on the drawings and the remainder of the backfill shall hereafter be placed as set out in Section 2 of this Specification.

Flexible joints shall be formed in concrete beddings, arches or surrounds in the location shown on the drawings. Such joints shall coincide with the pipe joint in such a way that the end of the socket is flush with one face of the joint and the socket faces into the joint space.

Joints in concrete beddings, arches and surrounds shall be 18 mm wide unless otherwise instructed by the Engineer and shall be filled with a compressible material such as a sheet of cane fibre board or cork board. The material used shall be subject to the approval of the Engineer.

Joints in Pipelines

Concrete pipes

(a) Rigid Joints

When laying rigidly jointed pipelines with pipes having integral sockets, before entering a pipe spigot into its socket, both spigot and socket shall be clean and free from mud, oil, grease or other deleterious matter. A gasket of tarred hemp yarn, cut to length so that it forms a butt joint at the crown of the pipe shall be wrapped round the spigot which shall then be fully entered into the socket and the gasket caulked up hard into the joint. The joint shall then be filled completely with a plastic mortar composed of one part of cement to two parts of sand.

The pipes shall not be pressure tested or disturbed in any way for at least 48 hours after jointing.

Rigidly jointed sleeves used to join two spigots shall be jointed in the same manner as integral sockets.

If the drawings require ogee jointed pipes to be laid with a mortar joint, the joint shall be made at the time of laying. Mortar as described above shall be applied to the lower semi-circumference of the socket and to the upper semi-circumference of the spigot and the pipe shall be drawn hard into the socket. Excess mortar squeezed out of the joint shall be removed from both the inside and outside of the joint.

(b) Flexible Joints
Flexible joints between pipes having integral socket may be formed by a shaped rubber gasket fitted within the socket or by a rubber ring of circular cross section (O-ring) placed on the pipe spigot. The type of flexible joint to be used shall be subject to the approval of the Engineer and shall be made strictly in accordance with the manufacturer’s recommendations.

**uPVC pipes**

Flexible jointed uPVC pipes shall be jointed in accordance with the manufacturer’s instructions.

Solvent welded joints shall be made strictly in accordance with the manufacturer’s instructions using solvent supplied by him for exposed pipes.

**Steel pipes**

These shall be caulked in thread seal for rigid joints. Flexible joints incorporating rubber O-rings shall be made in accordance with the manufacturer’s instructions. Joints incorporating bolted or screwed glands or couplings shall be made in accordance with the manufacturer’s instructions.

Components of flexible joints from different manufacturers shall not be used together.

**Connections to Existing Pipelines**

Where a connection is to be made to an existing water pipe other than that at a chamber, a pipe saddle of the correct size shall be used for this purpose. The hole in the pipe shall be cut precisely to fit the saddle.

Saddles for uPVC pipes shall be made of the same material as the pipes and shall be fixed with a solvent in accordance with the manufacturer’s instructions.

**Pipes Through Structures**

Where a pipeline passes into or out of a structure, including a manhole cover or similar chamber, two flexible joints shall be formed. The flexible joint shall consist of a 500 mm long pipe section connected along the main pipe, with the nearest end 500 mm from the face of the structure. One joint will be made on the incoming pipe and another joint on the outgoing pipe.

When the structure is less than one pipe length wide, the above requirement shall not apply and a sleeve shall be formed through the structure so that there is a clear space at least 75 mm wide all round the pipe. Adequate means shall be provided to prevent soil from entering this gap.

**Pipelines within Concrete Structures**

Sections of pipelines which are to be cast into concrete may be installed in advance of the remaining parts of the pipeline subject to the agreement of the Engineer. Such sections shall be placed accurately into position and fixed so that they can not move during placing of concrete around them.

**Tender Document:** Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes, NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
**Pipes under Roads**

All pipes at the crossing of driveways and roads shall be surrounded with concrete for the entire length of crossing before trench backfilling.

Concrete surround shall be approved by the Engineer on satisfactory compliance with protection of pipes as detailed in Section 5.9.

**Cleaning**

The insides of all pipes, valves, tanks and fittings shall be clean, smooth, and free from blister, loose scale and dirt when erected. All lines shall be cleaned after all installation work.

When pipes are installed all ends shall be suitably plugged until final fixing of fixtures can be carried out. Pieces of cloth or stone will not be permitted.

**Pressure Testing of Pipelines**

As the installation of the pipework proceeds, the various sections shall be tested before they are built in, concealed, or finally connected. The Contractor shall advise the Engineer in writing at least three days in advance of the carrying out of such tests, and such tests shall, if considered necessary by the Engineer, be carried out in his presence.

All tests shall be at the expense of the Contractor and it shall be the responsibility of the Contractor to make all necessary records of the tests and results and submit these to the Engineer in the final form agreed.

All pipe systems shall be tested hydraulically for a period of one hour to not less than one and a half times the design working pressure. Testing shall comply with BS 8010 for standard field testing of pipelines.

If preferred, the Contractor may test the pipelines in sections. Any such section found to be satisfactory need not be the subject of a further test when the system has been completed, unless specifically requested by the Engineer.

During the test, each branch and joint shall be examined carefully for leaks and any defects observed shall be made good by the Contractor and the section re-tested.

**Painting of Exposed Pipes and Fittings**

All metal surfaces within chambers shall be mechanically wire brushed to remove all loose scale, grease etc. Within two hours of cleaning a primer shall be applied, followed after two hours by a first coat of heavy consistency bitumen paint all to the approval of the Engineer. A second coat of the heavy consistency paint shall be applied after 24 hours. The final coating thickness shall not be less than 250 microns.

Preparation and application of the coating system shall be strictly in accordance with the Manufacturer's instructions.
This clause shall not be applied to chemically or thermally bonded coatings on steel pipes.

Maker Posts

Precast concrete marker posts shall be set in concrete and fixed near valves, fire hydrants, washouts, changes in direction of the mains and where directed by the Engineer. The posts shall be detailed as directed by the Engineer.

Water Tanks

Pressed Steel Tanks

The pressed steel tank shall comply with the BS 1564. The material thickness of the tank panels shall be 5 mm. The assembly of the tank shall be done in accordance with the manufacturer’s recommendations. The tank shall be provided with a cover which shall have a square manhole of at least 460 mm that give access to the interior of the tank. The tank cover shall be fitted with a suitable vent that is fitted with a suitable screen as recommended by the manufacturer to prevent the entry of insects and small animals.

A tank shall be fitted with external ladder, the length of which would be as shown on the drawings or as determined on site.

Each panel shall be clearly and indelibly marked to indicate its position in the tank.

Plastic Water Tank

Plastic based water tanks shall be tested in accordance with the requirements of BS 6920. For a tank to be acceptable it must give satisfactory results in tests designed to determine that there is:

(a) No test imparted to the water.
(b) No change in the appearance of the water.
(c) No growth of micro-organisms in the water, in contact with the materials or on the surface of the material.
(d) No release of substances into the water that may be of concern to public health.
(e) No release of metals into the water.

Chemical Mixing and Dosing

To facilitate chemical mixing and dosing at the clarifiers and chlorine contact tanks the contractor shall put following in place:

2 No. cylindrical chemical mixing tanks each of 100 litres capacity. The tanks shall be of GRP (glass reinforced plastic) manufacture and shall be fitted with fibreglass dissolving tray fixed at a third depth freeboard mark. The tanks shall also be fitted at the bottom with a PVC 15mm diameter stub pipe with a gate valve. The stub pipe shall connect the mixing tanks to the FRO chemical gravity dosers. The FRO dosers shall be installed on block masonry platform resting on the chlorine underground tank and shall be for each clarifier and chlorine contact tanks, as indicated on the drawings.
Each clarifier shall have a FRO (Patterson Candy International gravity or similar approved manufacturer) doser rated at 32 ml/sec with provision for adjustment of the dosing rate in accordance with the quantity and turbidity of the raw water to be treated.

The Contractor shall provide the necessary potable water supply pipework to the GRP mixing tanks for each site. The water supply pipework shall be non-corrodible and to the approval of the Engineer.

The solution pipework between the solution tanks and the doser shall also be non-corrodible and to the approval of the Engineer. Coagulation chemicals shall be dissolved in the upper compartment of the solution tank and shall flow by gravity to the FRO doser and into the mixing tank with water to be treated.

**STEELWORK**

**General**

Except where otherwise specified, structural steel shall be Grade 43, complying with BS 7668, "Specification for weldable structural steels".

All structural rolled steel members shall comply in dimension, weight and tolerance with that shown on the drawings and with BS 4, "Structural steel sections" and BS EN 10056, 10067 and 10210.

**Bolts, nuts and fastenings**

Bolts, studs, nuts and washers etc, shall be of mild steel unless otherwise specified. The dimensions and tolerances of nuts and bolts shall comply with BS 4190, "Specification for ISO metric black hexagon bolts, screws and nuts" or where specified to BS 3692, "Specification for ISO metric precision hexagon bolts, screws and nuts" and the threads shall be to BS 3643, "ISO metric screw threads". The heads of the bolts shall be forged out of the solid bar and the ends shall be cleanly cut with standard threads and the nuts must fit the bolts accurately and tightly. Washers of the shape and type indicated on the drawings shall comply with BS 4320, "Specification for metal washers for engineering purposes".

Where nuts, bolts and washers are required to be galvanized, the galvanizing shall be to BS 3382, "Specification for electroplated coatings on threaded components".

**Electrodes**

Electrodes used in welding mild steel shall comply with the requirements of BS 639, "Specification for covered carbon and carbon manganese steel electrodes for manual metal-arc welding".

**Contractor’s Shop Drawings**

Where the Contractor is required to undertake the detailed design of the steelwork components, he shall provide the Engineer with copies of detailed shop drawings for approval at least fourteen (14) days before commencing fabrication. The Contractor shall be responsible for the detailed design of all connections and
these shall be fully detailed on the shop drawings together with all dimensions, clearances, welding details and procedures, machining, marking, etc. The Contractor shall not commence fabrication until he has received the Engineer's written approval of the shop drawings. Approval of such drawings shall in no way relieve the Contractor of his responsibility for accuracy or the correct operation of the component.

Fabrication and Erection of Steelwork

The standard of workmanship and engineering practices to be adopted for fabrication and erection shall conform to BS 449, "Specification for the use of structural steel in building" and BS 5531, "Code of practice for safety in erecting structural frames".

The Contractor shall supply samples of materials and standards of workmanship as required by the Engineer. All samples approved by the Engineer shall be retained and shall be considered as setting the standard for all subsequent work.

Inspection of work will be carried out by the Engineer and the Contractor shall give sufficient notice of the date when fabricated steelwork is ready for inspection. The Contractor shall provide particulars of places and dates of manufacture of all materials for the Permanent Works and the names of the manufacturers. Copies in duplicate of all orders for materials shall be sent to the Engineer at the time of placing such orders.

The Contractor shall ensure that all foundation bolts and supports including built-in bolts, etc upon which the steelwork is to be erected are in the correct position and that the steelwork fits correctly in required positions without forcing or straining in any way. Any check by the Engineer of the Contractor's measurements shall not relieve him of his responsibility for obtaining this fit unless any errors in position are clearly not attributable to him.

No permanent bolting or site welding shall be done until proper alignment has been obtained. The Contractor may use temporary jigs, anchors or supports during erection, but must allow for thermal movement to take place freely at all times.

If the Contractor wishes to drill holes in or fix attachments to the steelwork to carry temporary work such as shuttering, he shall obtain the Engineer's approval of the positions and details of all such holes or attachments and shall close such holes and remove the attachments to the satisfaction of the Engineer.

On completion of erection of any part of the steelwork on which the Contractor wishes to add further works, such as roofing, he shall first obtain the Engineer's approval of the steelwork and remedy any defects required by the Engineer. Any approval given shall in no way relieve the contractor of his responsibility for ensuring the subsequent correct positioning and behaviour of the steel work of other parts of the structure.

Welding

All shop welds shall be carried out by qualified welders who shall be under competent supervision. All welding is to be carried out in accordance with BS 5135, "Specification for arc welding of carbon and carbon manganese steels". The Contractor's proposals for welding shall be submitted to the Engineer for approval before any work is undertaken.

The Engineer may call for a test of a welder's capabilities in accordance with BS 4872, "Specification for approval testing of welders when welding procedure is not required".
In the case of site welds, the welding procedure for making each type of joint shall be approved by the Engineer before the work is commenced and the Contractor shall make such trial welds as the Engineer may require to demonstrate the soundness of the proposed method and the competence of his workmen.

Where site welding is used all welded joints shall be subject to inspection by the Engineer. Any welds that are in the opinion of the Engineer defective shall be cut out and the welds remade to the satisfaction of the Engineer. The cost of such corrective measures including any resultant delays, shall be borne by the Contractor.

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**Painting General**

The Contractor shall submit to the Engineer for his approval details of the types and manufacturers of paints he is proposing to use, together with the manufacturer's recommendations concerning preparation of surfaces, primers and undercoats, application methods, safety precautions and drying times for each type of paint. All paints used in the Works must be supplied ready-mixed in unbroken, sealed containers, which clearly show the type, colour and manufacturer of the paint and carry detailed "instructions for use".

All metal surfaces on which paint is to be applied shall be blast cleaned as laid down in BS 7079, "Preparation of steel substrates before application of paints and related products", or other mechanical means and fully prepared in accordance with the manufacturer's recommendations. Applications of paint coatings on external work shall not be carried out or continued in mist, rain or excessively damp conditions. The Contractor shall take all necessary precautions to prevent dust and dirt coming into contact with freshly applied paint before it has dried.

Paints shall be applied either by brushing or spraying in accordance with the manufacturer's instructions. The thinning of paints shall not be permitted without the approval of the Engineer. Unless otherwise recommended by the manufacturer, the minimum interval between the application of a first coat of paint and the second shall be twenty four hours (24hrs). Special care shall be taken to ensure complete coverage of all corners, arises and openings without causing an excessive build-up of paint and avoiding runs.

Steelwork to be painted shall be clean and free from all rust, grease, oil and mill scale.

The Contractor shall provide all the relevant employees, visitors and any other persons who shall be exposed to the painting works, with personal protective equipment for the entire duration of their exposure to the paint works.

No separate payment will be made for the dust abatement measures and the costs thereof shall be deemed to be included in the respective unit rates and the Contract Sum.

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**Painting Steelwork Immersed in Water**

Steelwork subject to immersion in water shall be blast cleaned or thoroughly mechanically cleaned by an approved alternative process and immediately coated before leaving the factory with zinc phosphate or similar compatible metallic inhibitive primer with a minimum dry film thickness of 50 microns. Following drying of the primer, the steelwork shall be coated with one coat of non-toxic, non-tainting, high build bituminous paint to BS 3416, "Specification for bitumen-based coating for cold application, suitable for use in contact with potable water", having a minimum dry film thickness of 100 microns.
After erection, damaged areas of steelwork shall be mechanically cleaned and touched up with primer and bituminous paint to fully restore the factory applied coating system and thickness.

Finally, two overall finish coats of bituminous paint with a minimum dry film thickness per coat of 100 microns giving an overall minimum dry film thickness of the complete coating system of 350 microns.

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**Painting other steelwork**

Where steelwork, which is not galvanized and not subject to immersion in water is required to be painted, it shall be thoroughly cleaned and painted prior to leaving the factory with:

(a) one coat of zinc phosphate or similar compatible metallic inhibitive primer with a minimum dry film thickness of 50 microns.

(b) one coat of red lead primer with a minimum dry film thickness of 50 microns.

(c) two coats of micaceous iron oxide undercoat paint with a minimum dry film thickness per coat of 50 microns.

After erection, damaged areas of steelwork shall be mechanically cleaned and touched up with primer and undercoat to fully restore the factory applied coating system and thickness.

Finally, one overall finish coat of enamel gloss micaceous iron oxide paint with a minimum dry film thickness of 50 microns giving an overall minimum dry film thickness for the complete coating system of 250 microns.

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**Galvanising**

All steel and ironwork of whatever kind required to be galvanised is to be pickled in dilute hydrochloric acid and then washed, fluxed and stoved and coated with zinc by dipping in a bath of molten zinc. All components are to be immersed in the bath only for the time sufficient for them to attain the temperature of the bath, they are then to be withdrawn at such a speed that a coating of 80 microns thickness is achieved, or such other practical maximum thickness for the component as defined in BN EN ISO 1461:1999, "Specification for hot dip galvanised coatings on iron and steel articles".

The galvanising is to be carried out after all drilling, chipping, trimming, filing; fitting and bending operations are complete and shall cover all faces evenly.

After erection of galvanised steel components, damaged or welded areas shall be painted immediately after cleaning with two coats of metallic zinc primer with each coat having a thickness of 50 microns. The paint shall be applied strictly on accordance with the manufacturer’s instructions and shall be compatible with any subsequent paint systems to be applied.

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**Galvanised handrails**

Handrail tubes shall be 38 mm nominal diameter steel tube to BS 1387, "Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21
pipe threads”. The top and bottom rails shall be 900 mm and 450 mm respectively above floor level. The rails and vertical standards shall be connected using screwed steel pipe fittings to BS 1740, “Specification for wrought steel pipe fittings (screwed BS 21 R-series threads)”, where practical with the final connections being welded in accordance with Clause 6.6.

The handrail assembly shall be securely mounted on base plates fabricated of mild steel and attached to the base or foundation slab in a manner to be approved by the Engineer.

All sharp edges and rough areas shall be carefully ground off and the entire handrail assembly cleaned and galvanised in accordance with Clause 6.10.

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Gates

Gates of the types and sizes shown on the drawings shall be supplied and installed where indicated on the drawings. The gate shall be drop-tight and shall be suitable in all respects for use in raw water. The gates shall have flush inverts.

Gates shall be supplied complete with all frames, cills, seals, spindles, hand wheels and headstocks as required. The frames and gates shall be fabricated in galvanized steel as per WATERMAN Industries Ltd, or equivalent approved. The contact address for WATERMAN Industries as at the time of this tender are:

WATERMAN Industries, P O Box 458, Exeter, CA 93221, USA.
Web site: www.watermanusa.com

All gates shall have rising spindles with protection tubes, headstock, hand wheel etc. and intermediate supports where the spindle is longer than 1500 mm. Intermediate guide brackets are to be located 600 mm above the gate frame, 400 mm below the base of the headstock and at a maximum spacing of 1500 mm, to suit or as recommended by the manufacturer and as approved by the Engineer.

All gates on structures in the link, main and branch canals having a base gate width of 500mm or more shall be of Type A (Sluice gate with a control rising spindle and wheel) as shown on the book of drawings. All gates on structures in the link, main and branch canals with a base gate width of less than 500mm shall be of Type B (slide gate or “Hand pull”) as shown on the book of drawings. All gates on structures on the main feeder canals shall be Type B.

The gates shall conform to the following specifications or equivalent:

- Self-contained frame;
- Rising stainless steel frame;
- Flat back for wall mounting
- Maximum on seating pressure, measured from invert – 1.5 m
- Material for leaf, arms, hoist is: carbon steel Din 17100 St. 37-2(EN 10025 S235 JR)
- Non-geared hand wheel manual lift, mounted on the top of the frame
- Material of side rubbing plates, sill plate and pivot pins: Stainless steel ASTM A-276 type 304
- Side and bottom seals: Neoprene to ASTM D-200
- Mill finish on all stainless steel surfaces
- Epoxy paint on carbon steel surfaces

The contractor shall examine gate shape, measure and confirm all gate sizes on site. The contractor shall then obtain approval of the Engineer prior to purchase of the gates.
Stop-logs

Where shown on drawings, the stop-logs shall be hardwood of the stated dimensions and shall be approved by the Engineer before supplying to site. Where shown on the drawings stop logs shall be bolted to steel frames of stated dimensions to form hardwood gates.

ROADWORKS

General

Earthworks

Earthworks shall be carried out in accordance with the requirements of Section 2 of this Specification.

In carrying out the earthworks, the Contractor shall take all necessary precautions to avoid damage to or deterioration of the earthwork materials. He shall so arrange his work that water, which is brought onto or enters the earthworks at any time either in advance of or during construction shall be rapidly dispersed until the permanent work is completed.

Formation Level

Formation level on embankments and in cuttings shall be the surface level of the ground obtained after completion of the earthworks.

Preparation and Formation

The formation to carriageways and verges shall be prepared to the satisfaction of the Engineer, well cleaned, free from mud and slurry, properly shaped and compacted by rolling to an even and uniform surface as shown on the Drawings or directed by the Engineer. Where soft pockets become evident during rolling, they shall be removed and replaced with sound compacted material.

Unless directed otherwise by the Engineer the formation shall be covered by the sub-base within 48 hours after the preparation the formation.

Once the formation has been prepared, constructional traffic, other than that specifically required for subsequent roadwork operations, shall not be allowed to run thereon without the permission of the Engineer.

Gravel Wearing Course

On completion of the road formation the Contractor shall lay sufficient gravel wearing course over the full width of the carriageway to achieve the consolidated depth and camber shown on the drawings or as directed by the Engineer.

Gravel wearing course shall consist of suitable natural gravel obtained from borrow pits approved by the Engineer and complying with the wet sieve analysis given below:
Wet Sieve Analysis

<table>
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<tr>
<th>BS Sieve size (mm)</th>
<th>Percentage passing</th>
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<td>75</td>
<td>100</td>
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<td>100</td>
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<td>0.60</td>
<td>20 – 45</td>
</tr>
<tr>
<td>0.075</td>
<td>10 - 30</td>
</tr>
</tbody>
</table>

The gravel wearing course shall also comply with the following requirements:

- 4 day soaked CBR $> 20$
- Plasticity Index $> 25$
- Plastic Modulus $> 500$

The CBR shall be determined in accordance with BS 1377 Test 16 on a sample compacted to 95% of maximum dry density as determined by BS 1377 test B and then soaked for 4 days.

The material shall be spread in a uniform layer across the full width of the construction. The thickness of the layer shall be such that after compaction the thickness shall not exceed 150 mm. Where a greater final thickness is required the material shall be laid and processed in two or more equal layers.

The material shall be mixed to a uniform consistency and any oversize materials shall be removed to an approved spoil dump.

The work area shall be kept continuously drained and any damage caused by water accumulating on or running off the surface shall be made good.

If necessary, water shall be added to bring the moisture content to between 80% and 105% of the optimum prior to commencing compaction.

Compaction of Gravel Wearing Course

All rolling shall be carried out longitudinally along the carriageway commencing at the carriageway edges and working in towards the centre. Material is to be compacted to 95% of the centre. Material is to be compacted to 95% of its maximum dry density or such other percentages as indicated on the drawings. Maximum dry density shall be as determined by AASHTO T99.

The in-situ dry density of the compacted material will be determined by the sand replacement method described in Test No 15A in BS 1377 or such other test as the Engineer shall consider appropriate. Each layer of fill material shall be approved by the Engineer prior to the placing of subsequent layers. Where the material is too wet or too dry the Contractor shall have the option of collecting the moisture content by watering or drying as appropriate, or modifying his compaction procedure so as to obtain the required dry density.
Rehabilitation of Existing Access Roads

General

The provisions of Clause 2 shall apply save where expressly varied hereunder.

All interventions shown on strip maps provided are subject to confirmation by the Engineer on Site.

Site clearing

The width and length over which site clearing is to be carried out shall be as instructed by the Engineer.

Spoil of Unsuitable Material

This shall be in-situ material, which is unsuitable to remain in the road, and has been instructed by the Engineer to be spoilt. Unsuitable material shall be deposited in spoil areas located by the Contractor subject to the approval by the Engineer. The rate for spoil shall include for the cost of excavating the material, loading, transporting, depositing, spreading and levelling the material in a spoil area, all to the satisfaction of the Engineer.

Earthworks Fill

The Contractor shall supply from a source approved by the Engineer, place and compact suitable borrow material having a minimum CBR of 10%, at 95% compaction as determined by AASHTO T99 to areas that require to be raised or where there is a deficiency of in-situ material for reshaping.

Light Grading

Where this term is instructed, the road shall be graded to redistribute the existing material as required to achieve the specified cross section of the road, watered and compacted. This item applies where the required movement of material is not greater than 1 m³/m

Heavy Grading

The Contractor shall scarify the road surface, add fill material where required, reshape and compact to achieve the specified cross section. This item applies where the required movement of material is greater than 1 m³/m

Gravel Stockpiling

No separate measurement shall be made for stockpiling gravel and the Contractor will be deemed to have allowed for the costs elsewhere in his rates.

Overburden Removal

The removal of vegetation, topsoil and overburden at gravel borrow pits shall not be paid for separately. Contractor will be deemed to have allowed for the costs elsewhere in his rates. The same applies to any works required to access the borrow pits.
Haulage

The rate for gravel wearing course shall include for the supply of material, processing and compaction inclusive of extraction, loading and transportation to Site for a maximum haulage distance of 30 km one way. Where suitable gravel is not available within this distance, overhaul will be paid for. Measurement shall be the product of the volume of compacted material insitu and the haulage distance in excess of 30 km, one way, along the shortest route, as determined by the Engineer. The Contractor shall be responsible for the maintenance of this selected route at his own cost.

Drainage Works

Culvert installation

This shall include the provision and installation of a specified internal diameter including excavation and backfill to a compaction of 95% of maximum dry density as determined by AASHTO T99. The backfill material is to be approved by the Engineer. The rate includes any provisions necessary for diversion of traffic.

Mass Concrete, Beds and Surrounds

Unless otherwise shown on the drawings, the concrete shall be class C20/20

Mitre Drains and Catch Water Drains

These will be formed at the locations and the lines and levels shown on the drawings or instructed by the Engineer.

Side Drains

These will be formed to the lines and levels as shown in the drawings and at locations as instructed by the Engineer. Material excavated from the side drains may be incorporated into the reshaped road if suitable. Otherwise, it shall be spoiled in approved spoil areas.

Cleaning of Existing Drains

The Contractor shall clean existing blocked culverts and clear side drains as may be directed by the Engineer.

Repair of Existing Drains

The Contractor shall replace broken culverts, and repair or reconstruct broken wingwalls and headwalls as directed by the Engineer.
BUILDINGS

Demolitions and Alterations

Demolition

Demolitions, taking out and cutting away shall be carefully performed and every precaution shall be taken to ensure the safety of the works. If damage should occur in the carrying out of the demolitions or alterations the contractor shall reinstate and make good the same at his own expense.

Protection

Supply, erect and maintain during the cutting of openings etc., all necessary protection to the existing premises against damage by weather or other causes.

Laying the dust

Allow for laying the dust as far as possible during the alteration by watering with a hose or other means.

Making good

All making good of block work, building up of openings etc., shall be in solid block work unless otherwise described, in cement mortar (1:4) properly cut, toothed and bonded and pinned up to existing work and pointed where necessary.

Credit for Materials

Unless otherwise specified materials arising from the demolitions and alterations will become the property of the Contractor. If the Contractor wishes to allow a credit for any such materials the appropriate allowance should be included in the ‘credit’ column of the Bills of Quantities.

In the event that the Employer wishes to take possession of any such materials the Contractor will only be entitled to receive compensation to the amount of credit indicated.

Definitions of Terms

The following definitions explain and simplify the terms indicated in the description of the works.

1) Removal shall include:

Dismantling / pulling down/ taking down/ taking out/ taking up/ stripping etc., at the site of the works getting from the site of the works to the outside of building by whatever means is necessary and disposal.

2) Disposal shall include:

- Handling on site to store or to pick up point for loading;
- loading into skips or lorries;
- transporting away from site to yard, store or tip payment of all tip charges.

3) Making out shall include:

Infilling to voids, openings, gaps and the like and matching materials and construction to existing.

4) Making good shall include:

Work as last described consequent on the carrying out of other work.

5) Form opening in brickwork or blockwork shall include:

- Shoring up and needling as required;
- cutting the opening;
- designing, providing and inserting required beam or lintel and providing any calculations if required and obtaining building regulation approval;
- providing and inserting cavity gutters and the like;
- forming new arches and the like in face work to match existing;
- quoining up jambs;
- sealing cavity of hollow walls, at jambs and cill and providing and inserting damp proof course;
- making good face work and features to match existing;
- forming new external sub-cills or sub-thresholds to match existing;
- making good the plasterwork or other applied finishes including making out into reveals and providing metal angle beads to arrises where required;
- removing debris.

6) Block in/Blank off/Fill in opening in brick work or block work shall include:

- Carefully cutting out any flooring in opening and levelling and preparing for raising new work;
- cutting toothings for bonding in new work;
- filling the opening with brickwork or block work to match existing;
- making out face work including cutting out arches, cills or ornamentation around the opening and continuing any general face work pattern;
- wedging and pinning to existing soffit;
- providing and inserting matching damp proof course;
- making out any plasterwork including continuing any existing patterns or labours and making good between new and old work so that after decoration or weathering the original opening cannot be discerned remove debris.

7) Remove partition shall include:

- Shoring up if required;
- sizing, providing and inserting required timber beam if the partition is load bearing;
- taking off skirtings, picture rails and the like;
- stripping off lath plaster or other finished and insulation quilts;
- taking out doors, borrowed lights, hatches and the like, frames, linings and architraves and the like within any area of partitioning to be removed;
- dismantling and taking down studding or framed work;
- making good plasterwork or other wall and ceiling finishes including cornices and other enrichments;

8) Repair roof covering shall include:

The term repair as applied to a tiled or slatted roof includes any or all of the following operations as are necessary:

- Renew broken or missing tiles/slates to match existing including nailing with composition nails or securing with copper tingles;
- re-wedge and re-point flashings and making out with new as required;
- re-make tile/slate verges or eaves including any bedding and pointing;
- renew defective or missing ridge or hip tiles;
- remove debris.

9) Renew roof covering shall include:

The term renew roof covering as applied to a tiled or slatted roof includes:

- Lift and afterwards re-fix flashings, soakers, ridge, hip and valley coverings etc;
- strip existing roofing and battens, sort and set aside sound tiles/slates;
- renew battens and re-lay existing tiles/slates together with new tiles/slates as required all to match existing including sarking felt underlay whether previously provided or not, and including any special tiles/slates to eaves, verges, ridges and valleys;
- re-wedge and re-point flashings;
- remove debris.

10) The term renew roof covering as applied to a sheet metal, felt or asphalt roof includes:

- Strip existing roofing
- renovate sub-base as required
- lift and afterwards re-fix flashings
- renew roof covering to match existing
- re-wedge and re-point flashings
- remove debris.

11) Renew flashings and the like shall include:

The term renew flashings and the like as applied to pitched or flat roofs any or all of the following as may be applicable:

- Strip existing flashings, soakers, gutters, ridge and hip coverings
- renew all work previously removed in material or similar quality and substance
- re-wedge and re-point all new flashings
- remove debris.

12) Ease and adjust shall include:

The terms ease and adjust as applied to doors, cupboard doors, casement sashes and the like includes:

• Re-hanging on existing hinges;
• planing edges as necessary;
• oiling locks and hinges and leaving in working order.

Overhaul shall include:

The term overhaul applied to doors, cupboard doors, casement sashes and the like includes any or all of the following operations as are necessary:

• Cramp up loose tenon joints and wedge or re-wedge including gluing wedges;
• piecing in any damaged timber to door, frame and linings or architraves;
• re-hanging on existing hinges or renewing hinges if required;
• plane edges;
• plane off protruding tenons;
• re-fix ironmongery and locks or renew if required;
• oil locks and hinges;
• renew glass where cracked or broken;
• renew putties where loose, missing or defective

13) Strip existing installation shall include:

The term strip existing installation in relation to electrical installation includes:

• Disconnecting at mains and making safe
• disconnecting and taking out all existing conduit, wiring and fittings (except where conduit is to be re-used)

14) Strip existing installations in relation to plumbing and Engineering installations shall include:

• Turning off incoming supplies;
• disconnecting and taking out all existing appliances, fittings and pipe work;
• removing defunct pipe clips, fixings and the like;
• making good walls, floors, ceilings as required;
• removing debris.

Materials

Submission of Samples

As soon as possible after the Contract has been awarded, the Contractor shall submit to the Engineer a list of the suppliers from whom he proposes to purchase the materials necessary for the execution of the Works. Each supplier shall be willing to admit the Engineer, or his representative, to his premises during ordinary working hours for the purpose of obtaining samples of the materials in question. Alternatively, if desired by the Engineer, the Contractor shall deliver the samples of the materials to the Engineer's office, without charge. Samples of materials to be used as aggregates shall be taken and tested in accordance with the provisions of British Standard 812: Sampling and Testing of Mineral Aggregates, Sands and Fillers. Subsequent supplies shall conform, within the specified tolerances, to the quality of approved samples.
The information regarding the names of the suppliers may be submitted at different times, as may be convenient, but not source of supply shall be changed without the Engineer's prior approval.

Samples of materials approved will be retained at the Engineer's office until the completion of the Contract. Samples may be tested to destruction.

All materials delivered to Site must be at least equal in all respects to approved samples.

**Cement**

Ordinary Portland Cement and rapid-hardening Portland cement shall comply with the relevant section of the “Concrete Specification” or other standards as given in Concrete Specification.

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

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

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

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

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

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

**Aggregates for Concrete**

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

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

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

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

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

**Sand for Mortar**

a) Sand for mortar shall be natural or crushed stone sand and shall be in accordance with BS 1198-1200 where applicable to sands for general purpose mortars.

b) The source of the sand is to be approved by the Engineer.

c) At the Works the sand is to be stored on a clean, hard surface.

All building stone shall be capable of withstanding when wet a crushing stress of 10N/mm². The source of stone shall be approved by the Engineer and stone supplied there from shall be free from Magadi, overburden, mudstone, cracks, sand holes, veins, laminations or other imperfections. The stone shall be chisel-dressed into true rectangular blocks, with each surface even and at right angles to all adjoining surfaces, to the size specified. For exposed stonework the maximum permissible variation of any of the specified dimensions shall be 6mm provided that cut stone, supplied as ‘rock face’ stone may be hammer dressed on one face only, or on one face and one end, if in other respects it conforms with this Specification. Stones shorter than 375mm will not be accepted.

Unless the Engineer allows otherwise the Contractor shall at his own expense provide and dress four 100mm cubes of stone for testing.

The stone shall be sound when tested in accordance with BS 1438: Media for Biological Percolating Filters, (Sodium Sulphate Soundless test) except that:

i) The treatment shall be repeated for 10 cycles only; and

ii) The second criterion of failure shall be amended to allow for a loss weight of not more than 20% of its original weight.

**Stone Dust**

Stone dust for blinding shall be black trap screened to the following grading:

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

**Murram**

Murram shall be from an approved source quarried so as to exclude vegetable matter, loam, topsoil or clay. The California Bearing Ratio of the murram, as determined for a sample compacted to maximum density (as defined under Bs 1377) and allow to soak in water for four days, shall not be less than 30. This CBR is a guide to quality only and the compaction in the work will be judged by density.

**Water for Cement Treated Materials**

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

**Cement Mortar**

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

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

**Hydrated Lime**

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

**Calcium Chloride**

Calcium Chloride shall be of a good industrial grade, and shall be obtained from an approved source.

**Lime Mortar**

Lime mortar shall consist of proportions by volume as specified of hydrated lime and natural sand or
crushed natural stone or a combination of both as specified for cement mortar in clause 14.10. The
constituent materials shall be accurately gauged and mixed in an approved manner.

**Cement-Lime Mortar**

Cement-lime mortar shall consist of Portland cement, hydrated lime and natural sand or crushed natural
stone or a combination of both, as specified for cement mortar in Section 3 of this Specification. The
constituent materials shall be accurately gauged and mixed by volume in an approved manner in the
proportions specified.

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

**Cement Grout**

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

**Concrete Building Blocks**

Pre-cast concrete building blocks shall be in accordance with BS 2028 for Type A blocks from an
approved source.

The faces of the blocks shall be smooth, true to shape with sharp arrises and be free from pitting and
other surface defects.

**Tender Document:** Tender for Maintenance Service Contract for Irrigation Pumps
,Generators and Associated Installations in Country Wide National Public Irrigation Schemes
for the FY 2020-2021 , NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,
Building Stone

Stone used for building shall be the best quality hard local stone obtained from approved quarries and shall be sound throughout so as to ring when struck and shall be free from all defects. Stones shall be dressed into true rectangular blocks with each surface even and at right angles to all adjoining surfaces and equal to samples submitted to and approved by the Engineer.

Steel Reinforcement

Mild steel and hot-rolled high tensile steel rod reinforcement for concrete shall be as specified in British Standards 4449, 4482: Rolled Steel Bars and Hard Drawn Wire for Concrete Reinforcements. Cold-twisted high tensile bars shall be as specified in British Standard 4461 Metric Units: Cold-twisted Steel Bars for Concrete Reinforcement. Steel fabric reinforcement shall be as specified in British Standard 4483: Steel Fabric for Concrete Reinforcement, and shall be delivered to the Site in mats, unless the Engineer allows otherwise, and free from any permanent set tending to make it curl under vibration.

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

Granular Material for Pipe Beddings

Granular material for pipe beddings shall consist of well and evenly graded material such as gravel or broken stone, having a grading of 19mm to 5mm, free from fines, readily compactible and free draining. The grading of supplies will be frequently checked.

Concrete Pipes and Specials

Concrete pipes and specials shall comply with the requirements of British Standards 5591. They shall carry the British Standards Institution registration certificate trade mark, or test certificates shall be furnished by the manufacturers.

Concrete Porous Pipes

Concrete porous pipes shall comply with the requirements of British Standard 5911: Concrete porous Pipes for Under-drainage.

Concrete Drain Invert Blocks

Pre-cast concrete invert blocks shall be 150 mm dia. half round manufactured to the detail Drawings supplied from concrete of the appropriate Class specified in Section 3 of this Specification using maximum 12mm size aggregate. If required, cube test certificates shall be supplied by the manufacturer.

Concrete Slabs for Open Drains

Pre-cast concrete slabs for lining open drains shall be manufactured to the detail Drawings supplied from concrete of the appropriate Class as specified in Tables 14.2, 14.3 and 14.4 using maximum 12mm size aggregate. If required, cube test certificates shall be supplied by the manufacturers.

Drainage Ditch Warning Posts

Pre-cast concrete drainage ditch warning posts shall be manufactured to the detail drawings from concrete of the appropriate Class specified in Section 3 of this Specification. If required, cube test certificates shall be supplied by the manufacturers.

**Agricultural Tiles and Pipes**

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

**Manhole Covers and Frames**

Manhole covers and frames shall be basically in accordance with the requirements of BS EN 124: Cast Manhole Covers, Road Gully Gratings and Frames for Drainage Purposes, except that manhole covers shall be constructed of mild steel, concrete filled, and set in grease/bitumen for water tightness in accordance with the Local Authority’s standard detail drawings.

Foul water sewer manholes shall have triangular Grade ‘A’ heavy duty covers and frames. Circular manhole covers and frames shall be used on surface water sewer manholes, and also heavy duty covers where indicated on the drawings.

**Gully Gratings and Frames**

Gully gratings and frames shall be basically in accordance with the requirements of BS EN 124 497, nominal size 500mm x 350mm, except that the gully gratings shall be constructed of mild steel, concrete filled in accordance with the Local Authority’s standard detail Drawings.

**Pre-cast Concrete Manholes and Inspection Chambers**

Pre-cast concrete manholes and inspection chambers shall comply with the requirements of British Standard 5911: Concrete Cylindrical Pipes and Fittings including Manholes, Inspection Chambers and Street Gullies, and they carry the British Standard Institution registered certification trade mark, or test certificates shall be furnished by the manufacturers.

**Pre-cast Concrete Gullies**

Pre-cast concrete gullies shall be un-reinforced and shall comply with the requirements of British Standard 5911: Concrete Cylindrical Pipes and Fittings including Manholes, Inspection Chambers and Street Gullies.

**Manhole Step-irons**

Step-irons of general-purpose type shall comply in all respects with BS 1247: Malleable Step Irons.

**Timber**

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

**PVC Pipes**

uPVC pipes for potable water supply shall comply with BS 3505 and shall be of the type and class as specified in the Drawings or the Bills of Quantities. Where uPVC pipes are to be used for gravity
sewerage, they shall be to BS 5481 for sizes DN200 and above and to BS 4660 for under sizes. Laying, jointing and testing shall be to BS 5955. The joint shall employ a flexible rubber ring which shall meet the requirements of BS 2494. Laying, jointing and testing shall generally be carried out according to the relevant Clauses of this Specification and all as per the manufacturer's instructions.

**Bitumen**

Bitumen shall unless otherwise stated be commercial straight run of penetration 85 - 100 as specified in Table IV - I of the Asphalt Handbook of the Asphalt Institute (USA).

**Cut-Back Bitumen**

Cut-back bitumen shall be of the specified grade stated in Tables IV - 2 to IV - 4 of the Asphalt Handbook of the Asphalt Institute (USA).

**Bitumen Emulsion**

Bitumen emulsion shall conform to the requirements of British Standard 434: Bitumen Road Emulsion.

**Aggregates for Surface Dressing**

Aggregates for surface dressing shall consist of hard, rough, clean crushed rock (blacktrap) as approved by the Engineer. It shall be of approved nominal size and quality and otherwise in conformity with the requirements of British Standard 63: Single Sized Road Stone and Chippings.

**Dry Rubble Backing**

Dry rubble backing shall consist of broken stone of approved quality, graded from 100mm to 50mm.

**Pre-cast Concrete Kerbs, Channels, Edgings and Quadrants**

Unless otherwise stated in the Bills of Quantities pre-cast concrete kerbs, channels and edgings shall comply with the requirements of British Standard 7263: Pre-cast Concrete Kerbs, Channels, Edgings and Quadrants. The date of manufacture shall be marked on each unit. If required, test certificates shall be furnished by the manufacturers.

**Pre-cast Concrete Flags**

Pre-cast concrete flags/paving slabs shall comply with British Standard 7263: Pre-cast concrete paving slabs shall be 600 x 600 x 50 mm thick, laid on a 50 mm thick sand bed. If required, test certificates shall be furnished by the manufacturers.

**Paint**

All priming, undercoating and finishing paints shall be in accordance with British Standard 2521/4: Ready Mixed Oil-based Priming Paints, or British Standard 2525/32: Ready Mixed Oil-based Undercoating and Finishing Paints (Exterior Quality), as appropriate.

**Masonry and Block work**

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General

All masonry work shall be constructed from building stone as specified in Part 4 or approved concrete block work as specified in Part 4.

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

Workmanship

All masonry work is to be constructed in compliance with BS 5.

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

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

The stones and blocks shall be bedded, jointed and pointed in mortar (1:3) in accordance with Part 4, with beds and joints 9mm thick flushed up and grouted solid as the work proceeds.

All work shall be cured in accordance with the relevant requirements of Part 4.

Walling

Materials

1) Cement

Cement used for making mortar shall be as described in the Engineering specifications for “Materials”.

2) Lime

The lime for making mortar shall be obtained from an approved source and shall comply with BS 890 Class A for non-hydraulic lime. The lime to be run to putty in an approved lined pit or container. The water to be first run into the pit or container and the lime to be added until it is completely submerged, stirred vigorously until all lumps are disintegrated and shall be kept constantly covered with water and regularly stirred for at least four weeks. The resulting milk-lime then to be run through a fine sieve and run into a pit or other container and kept clean and moist for not less than two weeks before being used in the works.

3) Sand

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

4) Water

Shall be as described in “Concrete Work”.

5) Concrete Blocks

Concrete blocks shall comply with the requirements of BS 2028, 1384 except where amended or extended by the following clause. Blocks shall have square arises and corners. For fair faced work damage to arises and corners shall not exceed the removal of 6 mm of the blocks depth or thickness.

Concrete blocks shall have a minimum crushing strength of 3.5 N/mm² except when below the damp course level or in contact with soil when they shall have a minimum crushing strength of 7 N/mm², unless noted otherwise on drawings.

Hollow concrete blocks shall not be used below the damp course level or in contact with soil.

Concrete blocks used for external walls shall be Class ‘A’ and for internal load bearing walls they shall be at least Class ‘B’. Class ‘C’ blocks shall only be used for non-load bearing partitions.

No pre-cast blocks shall be incorporated into the works unless approved by the Architect. The delivery of present blocks from which samples tested do not comply with this specification shall be deemed defective. Any work constructed with blocks from which samples tested do not comply with this specification shall be deemed to be defective.

From every 1,000 pre-cast concrete blocks delivered to site ten blocks samples shall be provided for testing. The pre-cast block samples shall be selected in accordance with BS 2028, 1364. Samples of pre-cast concrete blocks for testing shall be tested for the following properties in accordance with the methods given in BS 2028, 1364 and the test results shall comply with the requirements of BS 2018, 1364 except where amended by this specification:-

(a) Drying shrinkage
(b) Compressive strength or transverse breaking load (as applicable)
(c) Wetting expansion *
(d) Density
(e) Dimensional Tolerance
(f) Cavity size

*Test only applicable for concrete blocks made with clinker aggregate.

Blocks shall also be tested to determine the suction rate. The test shall consist of weighing the block, placing in a tray of water such that only 3 mm of the block side is immersed for a period of sixty seconds +/- 2 seconds; quickly wiping off excess water and reweighing. The suction rate is the increase in weight due to water absorbed and shall not exceed 2kg/m²/minute. Blocks which have a suction rate exceeding 2kg/m²/minute may be used if the Contractor uses an approved water reactive additive in the mortar or can show that the blocks are wetted such that the blocks will have a suction rate not exceeding 2kg/m²/minute for a period of 24 hours from being laid and provided the blocks comply with all other requirements.
Concrete blocks shall be stacked on prepared dry areas free of clinker, ashes and sulphate bearing strata. Blocks of different strengths shall be stacked separately and clearly marked to differentiate the strengths.

Blocks shall not be used for a minimum of 7 days after manufacture and shall not be loaded for at least 14 days after laying. For the first 7 days after manufacture, blocks shall be cured by maintaining in a damp condition, e.g. covering with polythene sheeting after wetting blocks.

6) Hollow Clay Blocks

Hollow clay partition blocks shall comply with the provisions of BS 1190 Section 1 and are to be hard, well burnt, true to size and shape and with sharp arrises and keyed faces and joints and are to be obtained from an approved manufacturer and to be equal in every respect to a sample to be deposited with, and approved by, the Architect.

Blocks are to be 190 mm high (to give 200 mm course height including the joint) and of the thickness given herein. Cutting of blocks is to be avoided wherever possible and full use is to be made of quarter, half and three-quarter blocks, and blocks with conduit recesses.

7) Louvre Block Walling

(a) To be pre-cast concrete mix 1:1.5:3 or 25 N/mm2 (12 mm aggregate) but with 10 mm finished fair on all exposed surfaces, built in cement and sand (1:5) mortar with straight horizontal and vertical joints to flush pointed both sides.

(b) Each block to be size 200 mm x 400 mm x 200 mm high and consisting of two ends each 200 mm x 200 mm x 50 mm thick joined with a 50 mm thick twice cranked louvre with top end of louvre projecting 40 mm above tope of block.

8) Stone

All stone shall comply with the requirements of CP 121.202 for masonry and rubble walls respectively except where amended or extended by the following clauses.

Unless otherwise noted, all masonry walls shall be coursed squared rubble walling with mortar joints.

The size of stones for rubble walling shall be such that the length of stone does not exceed three times its height. For coursed squared rubble walls blocks shall not exceed 300 mm in height and shall be not less than 150 mm in height.

Where snecked rubble walls are specified, the snecks shall not be less than 100 mm square on the exposed face.

Stone for masonry shall have a minimum compressive strength of 10 N/mm2. (Stone shall not be required to be tested to failure). The density of stone for masonry shall be not less than 2300 kg/m3. The drying shrinkage of stone shall not exceed 0.05%.

Samples of stone provided for testing shall be tested for the following in accordance with the methods given in BS 2028, 1364 and the test results shall comply with the requirements of this specification.
(a) Compressive strength  
(b) Density  
(c) Drying shrinkage

The colour and texture of stone shall be uniform and consistent. Prior to delivering any stone to site, the Contractor shall supply the Architect with a sample of stone in order that he may approve the colour and texture. The Contractor shall ensure that sufficient suitable stone is available for the whole of the project prior to ordering the stone.

Where cast stone including stone described as artificial stone, reconstructed stone, etc., is specified the stone shall comply with the requirements of BS 1217.

Masonry shall be of stone, having no irregular faces and only the back face if not visible shall be left as from the saw.

Prior to ordering dry stone the Contractor shall demonstrate that the stone is durable. This may be done by supplying details of buildings constructed with stone from the same quarry and which has been exposed to the same environmental condition for at least ten years.

The maximum projection from the face of stone for rubble walls shall be 20 mm beyond the specified face of the wall.

The Contractor shall provide six samples of stone measuring 150 mm x 150 mm for testing prior to delivering any stone to site. As work proceeds the Contractor shall provide six samples 150 x 150 x 150 mm for testing from every 300 m² of work.

All stone shall be stacked on prepared dry areas free of clinker, ashes and sulphate bearing strata.

9) Fire Bricks

Clay fire bricks shall be obtained from an approved source and shall be hard, sound, square and clean well burnt and in respect of size shall comply with BS 3921: 1974 Section 2.

10) Wall Reinforcement

100mm Thick walls and where described other walls and partitions shall be reinforced with a 25 mm wide strip of No. 20 S.W.G. hoop iron built into alternate horizontal joints in the wall centre. The reinforcement shall be lapped and hooked at running joints, angles and intersections and carried at least 115 mm into abutting walls at junctions.

11) Wall Ties

To be 3 mm diameter galvanized mild steel wire twisted butterfly wall ties.

12) Damp-Proof Courses

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The bituminous felt sheeting for damp-proof courses shall be hessian based bituminous felt complying with BS 743 type 4A weighing not less than 3.85 Kgs. per square metre. The sheeting is to be lapped 150 mm at running joints and the full width of walls at angles.

**Workmanship**

1) Cement Mortar

Mortar described as cement mortar 1:4 shall be composed of 1 cubic metre (1498 Kgs.) of Portland cement and 4 cubic metres of sand. Other mixes such as 1:3, 1:5 etc. shall be similarly construed.

2) Mixing of Mortar

The constituent materials shall be measured separately when dry in specially prepared gauge boxes of sizes to give the proportions specified without consolidation of the contents by ramming and shaking. The mortar shall be mixed in an approved power driven mixer for not less than two minutes per batch and using the minimum quantity of water necessary to obtain a working consistency. The mixer shall be used as close as practicable to the works and mortar shall be used within 30 minutes of mixing. No partially or wholly set mortar will be allowed to be used or re-mixed.

3) General Construction

**Setting out**

The Contractor shall provide proper setting out rods and set out all work on same for course, openings, heights etc., and shall build the walls, piers etc., to the widths, depths and heights indicated on the Drawings and as directed by the Architect.

**Building in Wood Frames**

Openings for doors, ventilators etc., are to be set out and left un-built until the wooden frames have been fixed in position.

**Building in Metal Windows and Doors**

Openings for metal frames are to be wide enough for the frames to fit without being forced into position. Build the lugs into the joints of the walling and fill in the space between the walling and frame with cement mortar well tamped into the channel of the frames and point all round externally.

All frames must be set plum and level and free from twist.

**Walls to Receive Plaster & Similar Finishes**

All faces of walls to be plastered etc., to have all projections dressed off and joints raked out as key.

4) Building Walling

**Laying and Jointing**

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**Tender Document:** Tender for Maintenance Service Contract for Irrigation Pumps, Generators and Associated Installations in Country Wide National Public Irrigation Schemes for the FY 2020-2021, NIA/T/193/2019-2020 National Irrigation Authority, Nairobi, Kenya,

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All blocks shall be well wetted before being laid and the top of walling where left off shall be well wetted before commencing building. Walls to be kept wet three days after building. All walls throughout the works shall be carried up evenly in 200 mm courses except where courses of less depth are required to bring walling up to level of floors, windows and the like and where otherwise described, no part being allowed to be carried up more than one metre higher at one time than any other part and in such cases the joining shall be made in long steps so as to prevent cracks arising and all walls shall be levelled round at each stage. Not more than 3 metre height of wall shall be laid in any one day.

**Bonding**

The blocks shall be properly bonded together and in such manner that no vertical joint in any one course shall be within 115 mm of a similar joint in the courses immediately above or below. All walling of 300 mm thickness or less shall be built in single thickness of blocks. Walling exceeding 300 mm in thickness shall be built with through bonders not more than 1070 mm apart in each course as directed by the Architect.

Alternate courses of walling at all angles and intersections shall be carried through the full thickness of the adjoining wall. All perpends, reveals and other angles of the walling shall be built strictly true and square.

**Tolerances**

All courses of walls shall be level with a maximum deviation of +/- 3 mm in any one metre length and a maximum overall deviation of 10 mm for lengths of wall exceeding 3 metres. Walls shall be plumb with a maximum deviation of +/- 3 mm in any metre height of wall with a maximum deviation of +/- 10 mm in the total height of the wall or any storey.

All corners of walls which are shown as being at right angles shall be square with a maximum deviation of 3 in 1000. All walls shall be straight with a maximum deviation of +/- 3 mm in any one metre length and a maximum overall deviation of 10 mm in any length exceeding 3 metres.

All bed and vertical joints shall be an average of 10 mm thick with a maximum deviation of +/- 3 mm of block work, and stone rubble walls. Joints for stone masonry walls shall be 6 mm +/- 1 mm thick.

**Curing**

All walls shall be maintained in a damp condition for at least 24 hours after laying. Walls under construction shall be dampened by applying water with a brush and no hosing directly on to the wall shall be permitted. When work ceases on any section of wall polythene or Hessian shall be draped over the wall, for at least 24 hours. If Hessian is used, it shall be maintained continuously wet.

**Cavities**

Cavity walls shall be of the overall thickness shown on the drawings.

Cavities above ground level between leaves of block or masonry shall be free of mortar droppings or other debris. The Contractor shall take proper precautions to prevent mortar or debris entering the cavity.

Cavities below ground level shall be filled with mortar for cavities up to 75 mm wide and for cavities over 75 mm wide filling shall be concrete mix 1:3:6. Cavities shall be filled such that there is maximum of three times the thickness of the thinner leaf of the wall filled with wet mortar or concrete unless the wall is continuously supported for the depth.

**Backfilling**

Earth backfilling against walls shall be carried out such that the level of the backfill is always equal on each side of the wall.

When a wall has filling material on one side only to a fill width of more than three times the wall thickness, the wall shall be continuously supported during backfilling.

Backfilling shall not be carried out until at least seven days have elapsed since the laying of the blocks or stone.

5) **Reinforced Walls**

Steel reinforcing bars in walls shall be carefully placed and spacers used to ensure that a minimum of 20 mm cover is given to the reinforcement unless otherwise specified.

Horizontal reinforcement in mortar joints shall be laid such that the reinforcement is not in contact with the blocks or stone.

6) **Wall Ties**

Wall ties shall be provided to connect walls to steel or concrete columns and beams to connect two unbounded leaves of wall.

Wall ties shall be provided at 450 mm centres both vertically and 900 mm centres horizontally and shall be staggered when used to connect two leaves of un-bonded wall. Wall ties shall be embedded into each material by a minimum of 50 mm.

7) **Fair Face**

All concrete and hollow clay block work described as finished with a fair face is to be built to a true and even face with the joints finished as specified hereinafter.

8) **Pointing**

Pointing of walls shall be carried out as the work proceeds wherever possible. When coloured mortar is specified for pointing only the pointing shall be carried out after work has been completed.

Existing walls shall be prepared for pointing by raking out all loose friable material to a minimum depth of 15 mm to form a square recess. The joints shall then be wetted and new mortar shall be forced into the joints and finished as directed.

9) **Holes, Cutting and Chasing**
(a) putlog holes shall be not less than one course deep and carefully filled with a block cut to fit size of opening with beds and joints filled with mortar well tamped in after scaffolding is removed, and if in faced walls to match facing.

(b) Where walling is cut, holed or chased for conduits, pipes and the like all such cuttings etc., shall be filled in solid with cement mortar (1:4) prior to the application of finishes.

Painting and Decorating

Materials

1) Manufacturers

Except where stated all materials shall be obtained from approved manufacturers. The Contractor shall state the name and address of the manufacturer whose materials he proposes to use. Once approval has been given the Contractor shall not obtain materials from other sources without the prior written agreement of the Architect.

Painting products shall be obtained from one of the following approved manufacturers

(a) Crown Paints
(b) Basco Paints
(c) Sadolin paints
(d) Dulux Paints

All paint shall be grade A quality

2) General

Each succeeding coat of priming, undercoating and finishing (pigment) or clear coating shall be sufficiently different in colour as to be readily distinguishable.

All primers and paints in one system upon a particular surface shall be obtained from the same manufacturer.

The mixing of paints, etc., of difference brands before or during application will not be permitted.

3) Emulsion paints

Emulsion paints shall be matt or satin finish vinyl emulsion paint. Silk vinyl finish shall be used where specified. The first (mist) coat shall be thinned in accordance with the manufacturer's instructions.

4) Gloss paint

Gloss paint shall be hard gloss finish oil paint.

5) Blucheuring paint

Blucheuring paint for door handles and gutters is to achieve a wrought iron effect to be obtained from Sadolin paints or equal approved.

6) Automotive paint

Automotive paint is to be two pack epoxy paint on specified surfaces factory applied, with baked finish, by Sadolin or other approved manufacturer. Colour selection is to be to the Architects approval.

7) Bituminous solution

Bituminous solution for use on coated pipes, RC and block work faces beneath ground level shall be obtained from a manufacturer approved by the Architect.

8) Traffic paint

To be as Crown Paints, Road Paint or other approved for use on concrete block paving.

9) Lead based paints

The use of lead based paints will not be permitted.

10) Clear finishes

Clear finishes internally shall be clear polyurethane varnish one or two pack as specified.

11) Varnish

Varnish is to be an imported water based varnish/stain by Sadolin Paints or other equal approved.

12) Primers and undercoats

Unless otherwise specified, primers and undercoats shall be the type recommended by the manufacturer of the finishing coats specified for a particular surface. Primer for external bare metalwork surfaces shall comply with B.S. 2523.

13) Knotting

Shellac knotting shall comply with B.S. 1336.

14) White spirit

The white shall comply with B.S. 245.

15) Timber stain

Timber stain shall be oil based pigmented stain. The application of this material shall be strictly in accordance with the manufacturers written instructions. Tint and degree of application shall be to the approval of the Architect.

16) Textured coating

Textured coating is to be of proprietary manufacture approved by the Architect of an approved colour.

Technical information concerning the coating is to be submitted to the Architect before ordering, but the minimum qualities of the coating are to be as follows:

(i) Suitable for application internally and externally to plastered, rendered, concrete, (ii) block, stone, brick, asbestos and timber surfaces.
(iii) Minimum durability of 10 years even in exposed conditions.
(iv) Maintenance free.
(v) Built-in mould resistant fungicide.

17) Stopping

The stopping shall be as follows:

(i) Plasterwork shall be plaster based filler.
(ii) Concrete and brickwork shall be similar material to the background and finished in a similar texture.
(iii) Internal woodwork, plywood and block board shall be putty complying with B.S. 544.
(iv) External woodwork shall be white lead paste complying with B.S. 2029.
(v) Internal clear wood finishes: the stopping shall be that recommended by the clear lacquer manufacturer.

18)
19) Fillers

The fillers for internal joinery shall be the type recommended by the paint manufacturer for use with his type of paint or lacquer.

Stopper and fillers shall be tinted to match the undercoat, and shall be compatible with both undercoats and primers.

All materials shall be used strictly in accordance with the manufacturer's instructions.

Workmanship

1) General

Workmanship generally shall be carried out in accordance with B.S. C.P. 231, unless otherwise specified.

Before painting is commenced floors shall be swept and washed over; surfaces to be painted shall be cleaned before applying paint as specified, and all precautions taken to keep down dust whilst work is in progress.

No paint shall be applied to surfaces structurally or superficially damp and all surfaces must be ascertained to be free from condensation, efflorescence, etc., before the application of each coat.
No painting shall be carried out externally during humid, rainy, damp, foggy or freezing conditions or conditions where surfaces have attained excessively high temperatures or during dust storms.

No new, primed or undercoated woodwork and metalwork shall be left in an exposed or unsuitable situation for an undue period before completing the process.

No dilution of paint materials shall be allowed except strictly as detailed by the manufacturer's own direction, either on the containers, or their literature, and with the special permission of the Architect. For external work dilution of paints will not be allowed whatsoever. For internal work, where permitted by the Architect, undercoats may be thinned by the addition of not more than 5% thinners. Gloss finish shall not be thinned at all.

Metal fittings such as ironmongery etc., not required to be painted shall first be fitted and then removed before the preparatory processes are commenced. When all painting is completed the fittings shall be cleaned as necessary and re-fixed in position.

2) Brushwork

Unless otherwise specified, all primers and paints shall be brush applied. Written permission must be obtained from the Architect's if an alternative method of application is to be used.

3) Stopping and filling

Unless otherwise specified by the manufacturer all primers and undercoats shall be stopped flush and rubbed down to a smooth surface with an abrasive paper and all dust removed before each succeeding coat is applied. Care shall be taken to prevent burnishing of the surface.

4) Stirring

Unless otherwise specified by the paint manufacturer all paint materials shall be thoroughly mixed and/or stirred before and during use, and suitably strained as and when necessary.

5) Inspection

No priming coats shall be applied until the surfaces have been inspected and the preparatory work has been approved by the Architect. No undercoats or finishing coats shall be applied until the previous coat has been similarly inspected and approved.

6) Paint application

Each coat of paint shall be so applied as to produce a film of uniform thickness. All paint shall be applied in accordance with the manufacturer's instructions. Special attention shall be given to ensure that all surfaces including edges, corners, crevices, welds and rivets receive a film thickness equivalent to that of adjacent painted surfaces.

7) Drying

All coats shall be thoroughly dried before succeeding coats are applied. Allow a minimum of 24 hours between applications on any one surface, unless otherwise specified by the manufacturer.

8) Un-primed woodwork

Un-primed woodwork scheduled to be painted shall be rubbed down with abrasive paper and dusted off. Care shall be taken to prevent 'barnishing' of the surface. All knots and resinous areas shall be coated with two coats of knotting. Pitch on large, open unseasoned knots and all other beads or streaks of pitch shall be scraped off, or if still soft, shall be removed with white spirit before applying the knotting. Apply one coat of priming to all surface, two coats to all end grain, to be subsequently painted. Backs of all wood frames in contact with concrete, brickwork, block work and metalwork or similar materials shall be primed before fixing. After priming all joints, holes, cracks shall be stopped and filled, rubbed down and dusted off.

9) Primed woodwork

Woodwork delivered primed shall be lightly rubbed down with abrasive paper, and dusted off. Touch up bare areas with a similar priming including open grained ends. After touch priming all joints, holes, cracks and open grained ends shall be stopped and filled, rubbed down and dusted off.

10) Plywood and block board

Edges of exterior plywood and block board shall be sealed with two coats of aluminium primer and the backs treated with a lead primer.

11) Clear finished woodwork

All woodwork scheduled to receive a clear finish shall be well sanded with the grain removing all dirt etc., to give as smooth a surface as possible. Resinous timber shall be swabbed down with white spirit and dried thoroughly. Split or end grain shall be filled with suitable filler recommended by the clear lacquer manufacturer, in accordance with their instructions, and of the appropriate shade.

12) Bare metalwork

Bare metalwork shall be thoroughly cleaned off all dirt, grease, rust and scale by means of chipping, scraping and wire brushing; particular attention should be given to the cleaning of welded, brazed and soldered joints. Wash down with white spirit and wipe dry with clean rags. Apply a coat of metal primer immediately the cleaned surfaces have been approved by the Architect.

13) Galvanized metalwork

Galvanized metalwork scheduled for painting shall be thoroughly cleaned of dirt, grease, dusted and washed down with white spirit and wiped dry with clean rags. Any minor areas of rust shall be removed by wire brushing and spot primed with a zinc rich primer. Apply at least one coat of calcium plumbate primer to all surfaces subsequently to be painted.

14) Primed metalwork

If the priming coat of pre-primed metalwork has suffered damage in transit, or during erection on site, the affected areas shall be cleaned off by wire brushing, abrading and dusting off, the bared patches touched up with a primer of a similar type to that already applied.

15) Copper

Copper scheduled for painting shall be lightly abraded with emery cloth, washed with white spirit and wiped dry with clean rags. Apply a coat of etch primer immediately the cleaned surfaces have been approved.

16) Brickwork, concrete etc.

All brickwork, block work, concrete, rendered and plaster surfaces scheduled to be painted shall be brushed down, all holes and cracks filled, all projections such as plaster, or mortar splashes etc., removed to leave a suitable dust free surface. All traces of mould oil shall be removed from concrete surfaces by scrubbing with water, detergent and rinsing with clean water. All these surfaces shall be thoroughly dry before any primer or pains are applied. Apply a coat of alkali resisting primer where surfaces are to be finished with oil paints or alkyd resin type emulsion.

Asbestos cement surfaces scheduled for painting shall be brushed down to remove powdery deposits, and a coat of alkali resisting primer applied where such surfaces are to be finished with oil paints or alkyd resin type emulsion.

17) Colours

The colours will be selected by the Architect from the paint manufacturer's standard colour range.

18) Toxic wash

Concrete, block work, plaster and timber surfaces which are to be painted shall be washed down prior to painting with a toxic wash applied by brush or spray. A second wash shall be applied two days after the first wash. The surfaces shall be then allowed to dry out completely before application of paint.

19) Protection

Proper care must be taken to protect surfaces while still wet by using of screens and 'wet paint' signs where necessary.

20) Damage

Care must be taken when preparing surfaces, or painting etc., not to stain or damage other work. Dust sheets and covers to the satisfaction of the Architect shall be used to protect adjacent work. Any such stains or damage shall be removed and made good at the Contractor's expense.

21) Cleanliness

All brushes, tools, pails, kettles and equipment shall be clean and free from foreign matter. They shall be thoroughly cleaned after use and before being used for different colours, types or classes of material. Painting shall not be carried out in the vicinity of other operations that may cause dust. Waste liquids, oil soaked rag, etc., shall be removed from the building each day. Waste liquids shall not be thrown down in any sanitary fittings or drains.

22) Performance
If, while the work is in progress, the paint appears to be faulty, such as consistency of colour, drying time, or quality of finish, the work shall be stopped at once and the manufacturer consulted.

The manufacturer's of the materials shall be given every facility for inspecting the work during progress in order to ascertain that the materials are being used in accordance to their directions, and to take samples of their products from the site if they so desire for tests.

The finishing coats of the various paints or surface finishings shall be free from sags, brush marks, runs, wrinkling, dust, bare or 'starved' patches, variations in colour and texture, and other blemishes.

When the work has been completed, the finished surfaces shall not be inferior in quality, colour and finish to the samples approved by the Architect, and imperfections in manufacture shall not be apparent through these finished surfaces.

In the event that the Architect is not satisfied that the quality of finish does not comply with the required standards and/or the sample panel the Contractor will be required to repaint at his own expense, such work to the satisfaction of the Architect. If in the opinion of the Architect it is necessary to remove completely the unsatisfactory paintwork this shall also be done under the direction of the Architect at the expense of the Contractor.

23) Packaging, delivery and storage

All paints and surface coatings shall be delivered in sound sealed containers, labelled clearly by the manufacturers, the label or decorated container must state the following:

(i) The type of product.
(ii) The brand name and colour
(iii) The use for which it is intended
(iv) The manufacturer's batch number
(v) The B.S. number if applicable
(vi) All labels shall be printed - containers bearing type written labels will not be acceptable.

Materials shall be stored under cover in accordance with the manufacturer's instructions, and with local fire and safety regulations. The store itself must be maintained at a temperature of not less than 50 degrees F (10 degrees C) and must not be subjected to extreme changes of temperature.

The batch deliveries are to be dated and used strictly in order of delivery.

24) Vinyl emulsion paint

Surfaces to be painted shall receive one mist coat followed by two full coats of vinyl emulsion paint. Application may be by means of rollers or brushes.

25) Gloss finish paint

Surfaces to be painted shall be primed then painted with two undercoats followed by one coat gloss finish paint.
26) Clear polyurethane varnish

Surfaces to be clear varnished shall be treated with two coats water based as Sadolins (UK) Ltd or equal approved.

27) Textured Coating

The manufacturer’s instructions concerning application of the coating are to be strictly followed under the direction of the Architect.

All surfaces to receive textured coatings are to be clean and dry with surfaces scraped and brushed before application of the coating.

Application of the coating is to be with textured roller or fibre brush as directed by the Architect with a minimum spreading capacity of 1 kilogramme per square metre. Under no circumstances is the coating to be thinned.

Painting

General

The Contractor shall supply all paints, primers, varnishes, distemper, oil, etc. ready mixed in original sealed containers bearing the brand maker's name identifying the contents and giving directions for its proper use.

Painting materials shall be of the best quality products of recognised manufacturers, and shall be subject to the approval of the Architect. The quality of the finishing colours shall be capable of giving three years' minimum satisfactory performance under tropical conditions with high temperatures and humidity, and capable of withstanding temperatures of up to 60 Deg. C for long periods without colour change. Paints shall also be resistant to oils, acids and alkalis.

All surfaces to be painted shall be adequately cleaned and prepared to the satisfaction of the Engineer's Representative and shall be dry and free from any oils, greases, stains or other marks prior to being painted. The paint shall be well and evenly applied. Where sprays are used, markings of the edges of the painted area shall be carried out to provide a definite edge. Brushes and sprays shall be the correct size and type for the work being executed.

For painting applied in several coats each coat shall be of a different shade or colour from the others. Each coat shall be allowed to dry thoroughly and sufficiently harden before the next coat is applied.

All colours shall be selected and approved by the Architect.

All hardware and furniture for doors and windows, together with any exposed electrical installation in walls shall be removed before painting commences. Upon completion of all paintwork all such hardware and furniture etc. shall be re-installed and left in good working order. Floors shall be covered as protection against staining by paint.
Block Work

Surfaces of concrete and rendering to be painted shall first be washed down and then allowed to dry. Any efflorescence present shall be thoroughly removed, and the areas so affected shall be given a coat of porous alkali-resistant primer. After any traces of grease have been removed the surfaces shall be painted with two coats of emulsion paint of the copolymer acrylic type. Any cracks in walls shall be cleaned, filled and puttied up then left to dry before application of paint.

Plastered surfaces shall be left as long as possible to dry out before being painted and after any efflorescence has ceased to form and has been removed, they shall be painted with two coats of an approved porous emulsion paint. When a gloss paint finish is called for, this coat or coats should only be applied over the emulsion paint after an interval of at least six months.

Woodwork

Woodwork to be painted shall be reasonably dry and its surfaces shall be cleaned and made smooth by the use of fine sand paper obliquely across the grain. The surfaces shall then be dusted off with a dusting brush.

Knots shall be sealed with knotting putty to BS 1336, unless very resinous, when they shall be cut out and the depressions filled after priming. The work shall then be thoroughly primed by brush with a priming paint to BS 5082 and 5358, end grain being given two coats. Cracks, holes and open joints shall be stopped with a mixture of equal parts of hard stopping and linseed oil putty.

Two coats of undercoating of approved manufacture shall be applied, the surfaces being rubbed down between coats. The surfaces on being dry shall then be painted with a final coat of gloss paint leaving no brush traces or irregularities.

Hardwood surfaces shall not be painted but shall instead be treated with two coats of linseed oil, of the clear boiled type. The linseed oil shall be well rubbed in, until the surface of the wood is clearly capable of not absorbing any further linseed oil. The second coat shall be applied between 8 and 12 days after the application of the first coat.

Metalwork

Galvanised metal surfaces shall first be treated with one coat of mordant solution which shall in due time be carefully washed off. The surface shall then be primed with a calcium plumbate primer. When this has dried thoroughly, the surfaces shall be given one coat of undercoat and one of a gloss finishing paint.

All metalwork shall be cleaned free from all rust, scales, grease, oils and any other surface stains, and shall be given one coat of an approved primer compatible with the metal to be painted, two applications of undercoat and one application of a gloss finishing coat.

The Contractor shall seek specific instructions to paint any non-ferrous metal surface.

All metalwork which has been supplied with bituminous protection or painting prior to despatch from the place of manufacture, such as pipes, tubes, valves, manhole covers, etcetera, shall have all exposed surfaces painted after erection.

The manufacturer's primer or coating shall be made good to the same standard and specification as supplied, and shall then be given two coats of paint as follows:-

(a) Pipes, valves, manhole covers, and fittings, etc. exposed to view shall be painted with two coats of an approved "bitumastic aluminium paint" or similar approved paint.

(b) Pipes, valves and fittings, etcetera in manholes, or chambers shall be painted with two coats of bitumastic paint or other approved paint.

Structural Steelwork

All surfaces to be painted shall be dried and cleansed free of all oil, grease, dirt or other extraneous matter by the use of white spirit, water or other appropriate cleaning material. Where surfaces have been damaged in transit they shall be made good to the same standard to which they were originally protected. Where as a result of such damage the metal has been bared, the paint immediately adjacent to the affected area shall be trimmed down, the affected area cleaned by wire brushing and the protective paint system restored, to provide a coat by coat lapping at the junction of the new and old paint systems. Where welding has been carried out on site, the welds shall be de-slagged and wire brushed, and a protective paint system applied similar to that of the surrounding steel surfaces.

Where surfaces have been left unpainted and are to be connected by High strength friction grip bolts they shall be cleaned as specified in Specifications Section 20 and the contact surfaces brought together without further treatment. After bolting up, those surfaces which, being exposed are not protected, shall be wire brushed, primed and painted to the requirements of Specifications Section 20 to give a coat by coat lapping with adjoining painted surfaces.

Where surfaces have been left unpainted and are to be completely embedded in concrete they shall be cleaned of all oil, grease millscale or other extraneous matter immediately prior to concreting but shall otherwise be left untreated. Where steelwork is to be partially embedded in concrete the paint system shall be continued into the concrete for a distance equal to the least lateral dimension of the concrete forming the surround.

Unless otherwise specified the final coat of finishing paint Specifications Section 20 shall be applied to the immediate area of all steelwork connections after completion of erection. The main body of the steelwork, however, may be painted on site before erection, in which case any damage sustained during the course of erection shall be made good to the satisfaction of the Engineer. Painting will not be permitted when the temperature is below 3 C or when Relative Humidity is in excess of 85% or during wet weather.

Galvanising

Galvanising shall be hot dip galvanising conforming to the requirements of BS 729. Galvanising shall be applied at the rate of 610 g/m² of surface area in a uniform covering of 100 microns thickness.

Finishing Off

All surfaces including window panes shall be left clean and doors and window hinges lubricated.

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Finishings

General

1) Other specifications

All other specifications of this contract where applicable are deemed to apply equally to the finishings specifications.

2) Samples

The Contractor shall prepare at his own cost sample areas of the paving, plastering and rendering as directed until the quality, texture and finish required is obtained and approved by the Architect after which all work executed shall conform with the respective approved samples.

3) Finished thicknesses

The thicknesses of floor finishes quoted in this section of the specification shall be the minimum requirements.

Suspended floors shall have a constant structural thickness and have level top surfaces. The finished floor surface will equally have a constant level and any adjustment needed to achieve this effect with the varying floor finish materials is to be made in the screeds beneath the same.

Slabs bearing on the ground may be cast to varying levels, and be of constant thickness with varying formation levels, or have varying thicknesses at the option of the Contractor. This stipulation in no way relieves the Contractor of the requirements of the specification for structural work.

4) Materials generally

All materials shall be of high quality, obtained from manufacturer's to be approved by the Architect.

Cement, sand and water shall be as described under Concrete Work and Block work.

5) Bonding

Bonding compounds, etc., for use in applying plaster and similar finishes direct to surfaces without the use of backings or screeds are only to be used if approved by the Architect and are to be used strictly in accordance with the manufacturer’s printed instructions.

6) Chases, openings and holes

All chases, holes and the like which were not formed in the concrete or walling shall be cut, and all service pipes shall be fixed and all holes and chases filled with mortar before paving and plaster work is commenced. In no circumstances will the Contractor be permitted to cut chases, holes and the like in finished pavings or plasterwork.

In-situ Finishings

1) Generally

The term plastering refers to the operation internally and rendering to the same operation externally but for ease of reference the term plastering has generally been used in this specification to describe both operations.

2) Mixes

The methods of measuring and mixing plaster shall be as laid down under Concrete Work and the proportions and minimum thickness of finished plaster shall be in accordance with the following:

<table>
<thead>
<tr>
<th>Item of Work</th>
<th>Mix</th>
<th>Minimum Thickness and Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Plaster</td>
<td>1 part cement ¼ part lime 4 parts sand</td>
<td>12 mm finish to walls and ceilings steel trowelled finish unless otherwise specified</td>
</tr>
<tr>
<td>External Render</td>
<td>1 part cement 4 parts sand</td>
<td>12 mm finish with wood float finish unless otherwise specified</td>
</tr>
<tr>
<td>Tyrolean finish</td>
<td>Ditto</td>
<td>6 mm finished thickness in two coats on 10 mm plastered backing</td>
</tr>
</tbody>
</table>

To obtain greater plasticity a small quantity of lime may be added to the mixes for external plastering at the Architect’s discretion but in any case this is not to exceed 1/4 part lime to 1 part cement.

With regard to the lime mortars gauged with cement, the addition just before use, of the cement to small quantities of the lime/sand mix shall preferably take place in a mechanical mixer and mixing shall continue for such time as will ensure uniform distribution of materials and uniform colour and consistency.

It is important to note that the quantity of water used shall be carefully controlled. Plaster may be mixed either in a mechanical mixing machine or by hand.
Hand mixed plaster shall first be mixed in the dry state being turned over at least three times. The required amount of water should then be added and the mix again turned over three times or until such time as the mass is uniform in colour and homogeneous.

The plaster shall be completely used within thirty minutes of mixing and hardened plaster shall not be remixed but removed from the site.

3) Preparation of surfaces for plaster etc.

Irregularities in the surfaces to be plastered or rendered shall be filled with mortar, without lime, twenty four hours before plastering is commenced. Joints in block work, etc., are to be well raked out before plastering to form a good key. Smooth concrete surfaces to be plastered shall be treated with an approved proprietary bonding agent or hacked to provide an adequate key for the plaster.

All surfaces to be plastered or rendered shall be clean and free from dust, loose mortar and all traces of salts.

All surfaces shall be thoroughly sprayed with water and all free water allowed to disappear before plaster is applied.

As far as practical, plastering shall not be commenced until all mechanical and electrical services, conduits, pipes and fixtures have been installed.

Before plastering is commenced all junctions between differing materials shall be reinforced. This shall apply where walls join columns and beams, particularly where flush, and similar situations where cracks are likely to develop and as directed by the Architect. The reinforcement shall consist of a strip of galvanised wire mesh 'Expamet' or equal approved 15 cm wide which shall be plugged, nailed or stapled as required at intervals not exceeding 45 mm at both edges. The surfaces to which such mesh shall be applied shall be painted with one coat bituminous paint prior to fixing the mesh.

4) Application of plaster and render

After preparation of the surfaces a key coat of cement slurry shall be applied to the wetted surface to be plastered. When this coat is dry the plaster coat shall be applied, by means of a trowel, between screeds laid, ruled and plumbed as necessary. This coat which shall be to the required thickness shall be allowed to se hard and then cured as described. Surfaces are to be finished with a wood or steel float to a smooth flat surface free from all marks.

All plastering and rendering shall be executed in a neat workmanlike manner. All faces except circular work shall be true and flat and angles shall be straight and level or plumb. Plastering shall be neatly made good around pipes or fittings. Angles shall be rounded to 6 mm radius.

All tools, implements, vessels and surfaces shall be at all times kept scrupulously clean and strict precautions shall be taken to prevent the plaster or other materials from being contaminated by pieces of partially set material which would tend to retard or accelerate the setting time.

5) Curing of plaster
Each coat of plaster is to be maintained in a moist condition for at least three days after it has developed enough strength not to be damaged by water.

6) Angle beads

Where required by the Architect, salient external angles of plastered walls shall be protected with galvanized mild steel angle beads complying with BS 1246 Fig. 7 Profile C3.

They shall be securely plugged, nailed or stapled as required at intervals not exceeding 450 mm at both edges.

7) Plaster stops

Where shown on details, plasterwork shall be stopped against "Expamet" galvanized steel plaster stop, reference 565 which shall be securely nailed to walls in the positions indicated on the drawings.

8) Textured decorative plaster finishes

Textured decorative plaster finishes shall be a pre-mixed textured finish. The finishes shall be applied by trowel or roller as stipulated by the manufacturer for the particular finish as specified in the bills of quantities.

The finishes shall be applied strictly in accordance with the manufacturer’s instructions and to the approval of the Architect. Finished thicknesses shall be in accordance with the manufacturer’s recommendations.

Finish Type SP2 is to be applied to external walls and finish Type SP3 is to be applied to internal piers and columns and external veranda columns.

9) Cement and sand screeds

Screeds shall be mixed and formed as described.

10) Terrazzo and granolithic work

The whole of the terrazzo and granolithic work is to be carried out by a specialist sub-contractor who is to be specifically approved by the Architect and the contractor will be required to make arrangements for the execution of this work and bear all expenses incurred.

The materials used and method of construction for terrazzo work are to be in accordance with the BS Code of Practice CP 204/1951.

The surface finish to terrazzo is to be polished to comply with samples approved by the Architect.

The terrazzo topping is to be 20mm thick with imported white cement and 12mm marble aggregate, rolled and trowelled to a dense even surface and rubbed down at completion to a grit finished surface free from holes and blemishes.
Terrazzo features for capitals and bases will be either pre-cast or in-situ with the approval of the Architect. Colours shall be as selected by the Architect.

The paving is to be laid in squares divided by divided strips anchored securely in the screed and having their top edges truly level with the finished floor surface. The terrazzo work is to be laid and finished complete to the approval of the Architect.

The granolithic topping is to be 15mm thick and shall consist of one part coloured cement to two parts aggregate to 6mm gauge mixed with 15% fine dust. Aggregate is to be 70% black trap and remainder approved local coloured stone. Colours shall be as selected by the Architect. Paving is to be rolled and trowelled to a dense even surface and rubbed down at completion to a grit surface free from holes and blemishes. The paving is to be laid in squares divided by plastic strips anchored securely in the screed and having their top edges level with the finished floor surface.

The granolithic work is to be laid and polished complete to the approval of the Architect. The screed between the granolithic topping and the concrete floor is to be cement and sand (1:3)

The contractor is to twice scrub the topping with soap and water before twice wax polishing and handing over.

11) Dividing strips

Dividing strips shall be 3mm thick plastic and of a similar height as the paving in which they are embedded. Strips shall be cut to lengths and embedded in the pavings to form margins or bays to a detailed pattern or between differing floor finishes.

Dividing strips are to be cut as required to ensure a flush level surface with the paving.

12) Non-slip polished pavings

Where pavings are described as non-slip they shall have carborundum dust sprinkled evenly over the surface at the rate of one kilogram per square metre lightly trowelled in whilst still green.

13) Surface hardeners

Floor hardeners shall comprise an approved type guaranteed by the makers to produce a hard dense concrete with high abrasive resistance, impervious to the penetration of heavy oils, acid or alkali solutions and to be used strictly in accordance with the maker's instructions.

The first dressing of sodium silicate for granolithic flooring shall be one part of sodium silicate to six parts of water by volume.

Subsequent dressing shall be composed of one part of sodium silicate to four parts of water by volume, for all surfaces. The two liquids shall be well mixed together, sprayed over the flooring and spread evenly with a mop or soft brush, any excess being wiped off and the flooring allowed to dry for at least 24 hours after each dressing. After final drying, floors shall be washed with clean water.

14) Rates of in-situ work

The rates for in-situ work shall include for raking out joints of block work or bonding coat or spraying cement slurry on new concrete surfaces to form key, for work in narrow widths, small and isolated areas, rounded arrises, fair and chamfered edges, for making good up to boundaries of other work for making good and working around pipes, brackets etc., and for all other incidental labours.

Rates shall also include for masking before the application of spray finishes work executed overhead, temporary rules, supports, screeds and templates.

**Tiles, Slab and Block Finishings**

1) PVC Vinyl floor tiles

PVC vinyl floor tiles shall be imported as Marleyflex or other equal approved manufacturer.

PVC vinyl floor tiles shall be 2.5mm thick and comply with B.S. 3260 of an approved manufacturer to patterns as directed by the Architect. Adhesives are to be as recommended by the manufacturer in writing and approved by the Architect. Bitumen is not an approved adhesive.

The tiles are to be laid and bedded direct in adhesive on to a cement and sand bed to make up the total paving thickness.

The cement and sand screed is to be finished with a steel trowel to a perfectly smooth surface before the application of the mastic and tiling.

On completion the PVC vinyl tiles are to be sealed and polished with wax all in accordance with the manufacturer’s printed instructions.

Adhesives are to be polychloroprene as approved by the manufacturer and the Architect.

2) Clay tile paving

Clay tile pavings are to be in 200 mm x 200 mm tiles obtained from an approved manufacturer, and are to be laid on prepared screeds. The tiles are to be bedded in cement and sand (1:4) with straight joints in each direction. Upon completion grout in cement and wash and clean down. Tiles are to be cut with an electric tile cutting saw.

Finish to clay tiles to be three coats Transeal by Sadolin Ltd applied strictly in accordance with the manufacturers instructions.

3) Ceramic wall and floor tiles

The ceramic wall and floor tiles shall be from an approved manufacturer, and shall conform with the requirements of BS 1281. Tiles shall be of standard quality of the colours specified or approved. Tiles shall be laid with continuous straight joints and internal angles shall be butt jointed. Rounded on edge tiles shall be used at all external angles and at edges of panels. Cut tiles will be used in internal corners, full tiles in external corners.

Maximum joint size is 3mm when grouted.
Movement joints are to be at maximum 6m centres
Skirtings are to be formed in matching tiles, fixed with tile adhesive
300 x 300 special ribbed tread nosing tiles are to be utilised on all stair treads.

Tiles shall be well soaked in water, bedded in approved proprietary tile adhesive, pointed in an imported proprietary coloured grouting material, and cleaned and polished on completion.

4) Granite and marble tiling

Marble Tiling

20mm polished marble tiling in colours and sizes approved by the Architect. All tiles shall be carefully chosen for consistency in colour, size and texture.

Tiles to be bedded in sand cement bedding, and to be laid level with other adjacent finishes.

Granite Vanity Tops

Vanity tops to be formed in 600 x 400 x 20mm thick polished granite tiles, bedded in mortar on concrete vanity substrata. Edging tile to front edge to have rounded nosing, with vertical fascia panel, fixed with ‘Laticrete’ or equal and approved bonding agent.

5) PVC bead protection to wall tiling

PVC corner and edge beads to the Architects approval are to be provided to external corners and edges of ceramic wall tiles.

6) Expansion joint covers

Expansion joint covers are to be a proprietary imported stainless steel sliding cover with PVC infill strips fixed on both sides of structured movement joints. The contractor shall provide samples for the Architects approval.

7) Precast concrete paving slabs

To be all in accordance with B.S. 368. The slabs are to be of the sizes given herein and bedded, jointed and pointed in cement lime mortar (1:2:9).

8) Rates

The rates for tile, slab and block finishings shall include for rounded edge tiles and angles, cutting and fitting up to boundaries and around pipes, brackets, etc., and waste; for work in narrow widths, small and isolated areas and for all other incidental labours.

Suspended Ceilings

1) Generally

The Contractor shall provide shop drawings to show the final layout and sizes of members of all suspension systems and to co-ordinate the design and work of suspended ceilings with other trades to provide for the reception and installation of outlets, fixtures etc., pertaining to mechanical or electrical work, all for the Architect's approval before any work is commenced.

Ceilings shall be erected by workmen skilled in this work in a rigid and secure manner so that the final surface is free from any waves, buckles or sags.

2) Acoustic ceilings

Acoustic tile ceilings shall be 600 x 600 x 15 mineral fibre tiles, fine fissured finish, with regular edge in shops and WC’s with exposed powder coated suspended aluminium 24mm T frame grid system. All ceilings to have shadow gap trim to junction with wall, and to be set out with full tile at centre line in both directions of room or space ceiling installation. Manufacturer to be Armstrong or approved alternative, and to be installed entirely in accordance with the manufacturer’s instructions, incorporating all fittings and accessories, including suspension cable wires and hanger system.

The ceilings shall include a proprietary suspension system as recommended by the manufacturer. The suspension system shall be suspended from wire hangers fixed to concrete soffit and steel roof structures by an approved method. All to be fixed strictly in accordance with the manufacturers instructions.

3) Gypsum Plasterboard Ceilings

Plasterboard for ceilings to comply with the requirements of BS1230 Part I and to be manufactured under BS 750 Part 2 12.7mm thick. Fixing, installation and filling of joints to be strictly in accordance with manufacturers instructions. Plasterboard to have tapered edge, with taped and filled joints, finished in accordance with the manufacturers instructions.

The joints between boards shall be provided with a fine metal or plastic scrim tape, nailed or stapled to the boards so as to fully cover the joints and ready for a plaster skim.

Gypsum plaster skim coat

All joints between boards and blemishes in boards are to be skimmed with a fine proprietary gypsum plaster specially manufactured for that purpose. A gypsum plaster skim coat is to be applied to the whole surface of the gypsum plasterboard in accordance with the manufacturer’s instructions and to the approval of the Architect.

Plasterboard is to be fixed to a proprietary pressed metal brandering system to Architects approval.

4) Expanded metal lathing ceilings

Framework for expanded metal lath ceilings shall be as specified. Straps shall be bolted either to steelwork or to steel angle cleats raw bolted to concrete soffit.

Covering shall be galvanized expanded metal lathing Ref. 264 fixed to underside of suspension grid with 16 gauge soft galvanized tying wire or to underside of timber framing at maximum 356mm centres.

The whole to form a suspension grid ready and of adequate strength to receive plaster or other applied finish and with supports for lighting fittings where required.

The Contractor shall submit to the Architect for approval prior to erection, shop drawings showing the precise layout of suspended ceiling systems.

Rates for suspended ceilings

Rates shall include for shop drawings as specified; all hangers and supports as required including fixing same to concrete or ductwork; for angles at edges, for corner angles at upstands, for cutting and fitting around grilles and registers and light fixtures and for leaving in a perfect condition to the entire satisfaction of the Architect.

Rates shall also be deemed to include the use of plaster stops and angle beads around the edges and at all corners.
Rates shall include for all edge details, angle runners and light fitting frames as required.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

General

Environmental Responsibility

The Contractor will be required to include in his site staff an Environmental Specialist in his team to co-ordinate all aspects of the environment during project implementation. This will include following the construction to monitor, review and verify the implementation of the project’s Environmental and Social Management Plan (ESMP).

During construction, the Environmental Specialist will be responsible but not limited to the following tasks:

- Update environmental aspects (not covered in the ESIA / ESMP);
- Report to the Engineer on environmental issues that were included in the ESMP and the emerging ones during construction;
- Audit environmental and safety aspects at the work sites;
- Participate in the definition of the no working-areas and the location of campsite, borrow pits, quarries and other areas;
- Recommend solutions for specific environmental problems;
- Liaise with Community Liaison Groups with regard to compliance of the social clauses of the Contract, in terms of local labour force and HIV/AIDS campaign;
- Oversee strategies for sensitising Contractor’ staff on health and safety problems;
- Attend consultations held at key stages of the project with the community and interested parties;
- Liaise with the respective Environmental Authorities on the level of compliance with the ESMP achieved by the Contractor on a regular basis for the duration of the contract;
- Control and supervise the implementation of the ESMP;
- Prepare quarterly environmental and social progress or “audits” reports on the status of implementation of measures and management of work sites.

Updated Environmental Management Plan

An updated Environmental Management Plan will be required to be prepared to identify emerging and sequence environmental activities that are needed in order to complete a required construction process.

The Environmental Management Plan would identify reference documentation, the approval required to complete that activity and the verification documentation to be produced as evidence of satisfactory completion. The Environmental Management Plan would also identify where “hold points” would be required. These are where continuation of subsequent activity is prohibited unless a former activity has been signed-off. The ESMP would be broken down into various activities as listed in ESIA Report will be undertaken.

Method Statements

Method statements would be completed on behalf of the Main Contractor or Sub Contractor by the Environmental Specialist, in consultation with on-site Engineering staff. The method statements would include a review of the environmental risks and commitments, as identified in the ESMP and risk assessment, so that appropriate control measures are developed and included within the construction process.

Method statements would be reviewed by the Consultants Environmental Manager. Where necessary, all method statements would be submitted to the enforcement agencies (EMA and District Assembly.) as appropriate. Method statements would contain as a minimum:

- Location of the activity and access/egress arrangements.
- Work to be undertaken and methods of construction.
- Plant and materials to be used.
- Labour and supervision requirements.
- Health, safety and environmental considerations.
- Any permit or consent requirements.

Control of Construction Processes

Training, Awareness and Competence

The raising of environmental awareness is viewed as a crucial element in the appreciation and implementation of the Construction Environmental Management Plan (CEMP). As a consequence, all of the Contractor’s staff will undergo environmental awareness training, initially by way of the pre-start induction process. A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities will be produced and contained within the CEMP. Training for all personnel identified in the training plan will be completed before commencement of the associated construction activities. Line managers and supervisors would ensure that all personnel engaged in activities that may have an impact on the environment are competent to carry out their duties or, where necessary, arrange for suitable training to be undertaken.

Supervision of Construction Activities

All construction and installation activities including those carried out by subcontractors and suppliers would be supervised, or regularly checked through the completion of site inspections by the Contractors Environmental Specialist, to ensure that requirements identified in risk assessments or method statements have been implemented. The frequency and extent of this supervision will vary according to the degree of competence displayed by the workforce and the level of risk to the environment.

Inspection of Other Operational Impacts

Appointed environmental representatives would carry out weekly inspections of their respective construction areas, to verify that housekeeping or supporting controls are being implemented.

effectively. These inspections would utilise the site environmental standards as the minimum standards that should be achieved, with necessary actions being recorded and raised at weekly progress meetings. Subsequent inspections would commence with a review of all outstanding actions from previous reports to verify that they have been completed.

**Inspections by the Environmental Team**

Environmental deliverables required by the Construction Environmental Management Plan (CEMP) will be subject to regular independent inspections by either the Environmental Manager or the relevant environmental specialists. These inspections will be used to confirm that:

- Construction works are progressing in accordance with the agreed method statements’;
- Agreed protection or mitigation measures are in place, prior to or during the implementation of construction activities;
- Construction works have been completed in accordance with the design and;
- Commitments made during the statutory process.

**Environmental Inspection and Reporting**

The Contractors Environmental Manager would carry out an assessment of the Project’s environmental performance, based upon the reports from the environmental management representatives during the period, reports from the environmental specialists and from his own site inspections. This would be carried out at a frequency at no greater than monthly intervals but could be held more regularly depending on the nature of the construction activity. An assessment of the performance over the month would be made and quantified. A monthly report detailing performance for the period would be provided to the Engineer and would include a summary of environmental inspections completed, audits undertaken, complaints and incidents.

**Environmental Monitoring**

Monitoring of noise, vibration, dust and water quality would be carried out in accordance with the specialist environmental procedures and environmental commitments made.

**Control of non-conformance**

Non-conforming products or processes would initiate a Non-Conformance Report, which would identify the nature of the problem, the proposed corrective action, action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out.

**Communication and Co-ordination**

Internal project communications would be via two processes:

- Weekly team meetings;
- A monthly Project Environmental Review;

**Weekly team meetings**

Weekly meetings chaired by the Client’s Environmental Manager will be held by each of the construction teams to review performance and co-ordinate short-term planning of forthcoming activities. Environmental management representatives would use these meetings to report on the findings of their inspections together with any systematic or recurring issues. Actions from these meetings would be recorded via minutes and reviewed by the Contract Manager.

**Monthly Project Environmental Review**

Environmental issues will be primarily discussed at a monthly Project Environmental Review, chaired by the Contract Manager and attended by the Contractors Environmental Manager, the Clients Environmental Manager, relevant sub contractors environmental representatives and, when necessary, environment specialists and representatives from statutory consultees. The Project Environmental Review will:

- Consider past performance from inspections, audit reports and monitoring data.
- Plan actions required to mitigate forthcoming risks.
- Disseminate best practice.

Environmental due diligence during construction

During the construction phase, environmental due diligence will be incorporated into the Project implementation mainly to:

- Control the residual risk of accidental environmental damage;
- Prevent the negative environmental impacts during construction.

The contractor will be required to include environmental considerations in the monthly progress reports and indicate progress in the implementation of mitigation measures as outlined in the ESMP.

The Construction risks to be monitored will include, but not be limited to the following issues:

- Handling of hazardous materials as part of construction activities;
- Movement of machinery;
- Management of borrow areas;
- Sedimentation of watercourses;
- Collection and disposal of wastes;
- Management of pollution incidents.

Tables 10.1 gives a summary of the Environmental and Social Management Plans during Construction phase of the project.
Table 10.1 Environmental and Social Management Plan for Proposed K'onyango Irrigation Development Project

<table>
<thead>
<tr>
<th>Project Activity/ environmental concern</th>
<th>Possible Impacts</th>
<th>Mitigation Measures</th>
<th>Institutional Responsibility</th>
<th>Time Frame</th>
<th>Estimated Costs (KES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Land Take                               | Permanent and temporary loss of land | • Compensation of land lost at Full Replacement Cost;  
• Transition allowance for land tenants of three month yield costs;  
• Provision with an alternative land of the same or more reproductive value within the project area. | N.I.B | Before construction | RAP Report |
| Economically displaced people           |                 | • Include valuation report on the extent of economic loss by PAPs in the full RAP for compensation.  
• Measures to reduce instances of loss of income or livelihoods during the transition period to the new system.  
• Where possible, skip areas where crops are almost mature for harvesting during canal construction. | N.I.B | Before construction |                       |
| Full or partial loss of structures      |                 | • Cash compensation of the affected structure at Full Replacement cost;  
• Allowance to repair the remaining part of the structure for partial damage. | N.I.B | Before construction |                       |
| Flooding                                | Destruction of crops and homes | • Strive to construct most of the canals to completion during the dry season.  
• Regularise checks and inspection of the canals to avert blockages or leaks. | N.I.B | During Construction | No additional costs to BOQ |
| Vegetation Loss                         | Reduced biodiversity and loss of indigenous trees and shrubs | • The clearing of vegetation and trees, especially indigenous trees, should be strictly controlled and only done if it’s absolutely necessary.  
• Disturbed areas adjacent to the canals should be re-vegetated with locally occurring grasses, shrubs and trees after completion of each section. | NIB | During Construction | No additional costs to BOQ |

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CONSTRUCTION TOLERANCES

General

The following are the tolerances within which the works are to be executed or as directed by the Engineer:

Earthworks

Top level of Embankments after compaction +100/ -0 mm
Sides of Embankments over a 10 m length +100/ -0 mm
Channel or Excavation cutting +20/ -20 mm
Channel Water Way Area - 0
Horizontal Alignment of Channels: Maximum 300 mm
Over 20 m length 100 mm
Formation Level for Structures +0/ -ve filled with concrete
Formation Level for Gabions +0/ -100 mm

Concrete Structures

The following tolerances shall apply to all wrought formed and fair or fine unformed finishes.

Tolerance from Specified Position

Maximum departure of plan position of structure 150 mm

Tolerance from Specified Dimension

Maximum departure in thickness, cross-sectional dimension or position of columns, beams, walls, footings and the like +25/ -10 mm

Surface Tolerance on Straightness or Departure from Specified Curve

General Surfaces

Maximum deviation in horizontal or vertical direction
• gradual over a 10m length 25 mm
• abrupt 10 mm.

**Surfaces in Contact with Flowing Water**

Maximum deviation in direction of flow or normal to flow

• gradual over a 10m length 15 mm
• abrupt 5 mm

**Reinforcement**

Maximum departure in required spacing 15 mm
Minimum lap length shall be:
- In the case of mild steel reinforcing 40 times bar diameter
- in the case of high yield steel reinforcing 50 times bar diameter

**Stonework**

Pitching and Masonry over a 2 m length +100/-25 mm
Face of gabion basket + 75/-25 mm
Thickness of tipped rock or filter layer +100/-0 mm
SECTION VII - STANDARD FORMS

Notes on the standard Forms

1. **Form of Tender** - The form of Tender must be completed by the tenderer and submitted with the tender documents. It must also be duly signed by duly authorized representatives of the tenderer.

2. **Price Schedule Form** - The price schedule form must similarly be completed and submitted with the tender.

3. **Contract Form** - The contract form shall not be completed by the tenderer at the time of submitting the tender. The contract form shall be completed after contract award and should incorporate the accepted contract price.

4. **Confidential Business Questionnaire Form** - This form must be completed by the tenderer and submitted with the tender.

5. **Tender Security Form** - When required by the tender document the tenderer shall provide the tender security either in the form included hereinafter or in another format acceptable to the procuring entity.

6. **Performance security Form** - The performance security form should not be completed by the tenderer at the time of tender preparation. Only the successful tenderer will be required to provide performance security in the form provided herein or in another form acceptable to the procuring entity.

7. **Manufacturers Authorization Form** - When required by the tender documents this form must be completed and submitted with the tender documents. This form will be completed by the manufacturer of the goods where the tenderer is an agent.

8. **Anti-Corruption Declaration Form** - This form must be completed by the tenderer and submitted with the tender.
1. **FORM OF TENDER** (MUST BE FULLY COMPLETED AND SIGNED BY THE TENDERER ON THEIR LETTER HEAD)

To: 

Name and address of procuring entity

Date

Tender No.

Tender Name

Gentlemen and/or Ladies:-

8.9.4 Having examined the Tender documents including Addenda No. (Insert numbers) …….. the receipt of which is hereby duly acknowledged, we the undersigned, offer to provide Services under this tender in conformity with the said Tender document for the sum of …………………………………………………………………………..

………………………………..[Total Tender amount in words and figures]

or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Tender.

2. We undertake, if our Tender is accepted, to provide the Services in accordance with the conditions of the tender.

8.9.5 We agree to abide by this Tender for a period of …………….[number] days from the date fixed for Tender opening of the Instructions to Tenderers, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

8.9.6 This Tender, together with your written acceptance thereof and your notification of award, shall constitute a Contract between us subject to the signing of the contract by both parties.

5. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this _______________ day of ______________________ 2017

__________________________________________

[Signature] [In the capacity of]

Duly authorized to sign tender for and on behalf of ____________


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2. PRICE SCHEDULE FORM/PRICE SCHEDULE OF SERVICES

NOTE:
The prices for the works include labour, transport, out-of-station expenses for twice quarterly preventive maintenance and breakdown calls. Tenderers shall provide prices for each of the schemes, Western Kenya Scheme (Ahero, West Kano, Bunyala, Rwamba Mudembi, Sisenye), Bura Scheme, Mwea and Hola Scheme, Usueni and Galana Kulalu Food Security Project. The Western Kenya Schemes shall have an overall price comprising of five pump stations: Ahero, West Kano, Bunyala, Rwamba Mudembi and Sisenye.

EXCLUSIONS FROM FIXED PRICES

The price does not include:

(i). Spare parts used during preventive maintenance and breakdown calls.
(ii). Units for which replacement will be necessary because of normal wear.
(iii). All repairs (labour and materials) following an accident, wrong use or modification
(iv). Repairs (labour and materials) resulting from voltage hikes or motor reversals after restoring power supply.
(v). Major overhaul or change of complete unit.
(vi). All fees payable for statutory and regulatory inspections where applicable.

Works not covered by this Contract shall be advised by the EMPLOYER in time, giving estimate for repairs.

1.0 FIXED PRICE

The amounts quoted on the pricing schedules are monthly prices inclusive of VAT based on:

Fixed prices per unit in KES per visit
### A1 BURA PUMPS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Transport from Nairobi to Bura Irrigation Scheme</td>
<td>KM</td>
<td>900</td>
<td></td>
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**Subtotal Carried to summary**

### A2 BURA GENERATORS

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**Subtotal Carried to summary**
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### B1 HOLA PUMPS

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Total Carried to Summary

### B2 HOLA GENERATORS

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Total Carried to Summary

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### C1 RWAMBWA MUDEMBI

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### D1 WESTKANO SCHEME

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Subtotal Carried to summary

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Subtotal Carried to summary

### G1 HEAD OFFICE GENERATOR (85 KVA)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Coolant</td>
<td>Lts</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Engine Oil</td>
<td>Lts</td>
<td>20</td>
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</tr>
<tr>
<td>3)</td>
<td>Oil Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>4)</td>
<td>Fuel Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5)</td>
<td>Air Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6)</td>
<td>Battery Water</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7)</td>
<td>Margin on parts</td>
<td>Item</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8)</td>
<td>Consumables</td>
<td>Item</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9)</td>
<td>Transport from Tenderer’s Head Office to NIB’s Head Office Lenana Road, Nairobi</td>
<td>Km</td>
<td></td>
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</tr>
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</table>

**Subtotal Carried to summary**

### H1 MIAD GENERATOR (40 KVA)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Coolant</td>
<td>Lts</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Engine Oil</td>
<td>Lts</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td>Oil Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td>Fuel Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5)</td>
<td>Air Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6)</td>
<td>Battery Water (1 litre)</td>
<td>No.</td>
<td>2</td>
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<tr>
<td>7)</td>
<td>Margin on parts</td>
<td>%</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8)</td>
<td>Consumables (actual items to be specified during contract execution and invoicing)</td>
<td>Item</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>9)</td>
<td>Transport from Tenderer’s Head Office to MIAD Centre and return</td>
<td>Km</td>
<td>240</td>
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</tr>
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</table>

**Subtotal Carried to summary**

---


Page 189 of 203
### I1 MWEA IRRIGATION SCHEME GENERATOR (40 KVA)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Coolant</td>
<td>Lts</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Engine Oil</td>
<td>Lts</td>
<td>15</td>
<td></td>
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</tr>
<tr>
<td>3)</td>
<td>Oil Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td>Fuel Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5)</td>
<td>Air Filter</td>
<td>No.</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6)</td>
<td>Battery Water</td>
<td>No.</td>
<td>2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7)</td>
<td>Margin on parts</td>
<td>%</td>
<td>10%</td>
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<td>8)</td>
<td>Consumables (actual items to be specified during contract execution and invoicing)</td>
<td>Item</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9)</td>
<td>Transport from Tenderer’s Head Office to Wan’guru and return</td>
<td>Km</td>
<td>200</td>
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**Subtotal Carried to summary**

### J1 USUENI IRRIGATION SCHEME

<table>
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<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
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</thead>
<tbody>
<tr>
<td>1)</td>
<td>Transport from Nairobi to Usueni Irrigation Scheme</td>
<td>KM</td>
<td>700</td>
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<td>2)</td>
<td>Pumps inspection</td>
<td>No.</td>
<td>6</td>
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<tr>
<td>3)</td>
<td>Pump Control Panel Inspection</td>
<td>No.</td>
<td>6</td>
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<tr>
<td>4)</td>
<td>Accommodation</td>
<td>Days</td>
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<td>5)</td>
<td>Consumables</td>
<td>Item</td>
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**Subtotal Carried to summary**
### K1 GALANA KULALU PUMPS

<table>
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<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
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</thead>
<tbody>
<tr>
<td>1)</td>
<td>Transport from Nairobi to Galana Kulalu Scheme</td>
<td>KM</td>
<td>850</td>
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<tr>
<td>2)</td>
<td>Pumps inspection</td>
<td>No.</td>
<td>9</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td>Pump Control Panel Inspection</td>
<td>No.</td>
<td>9</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4)</td>
<td>Accommodation</td>
<td>Days</td>
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<tr>
<td>5)</td>
<td>Consumables</td>
<td>Item</td>
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</table>

Subtotal Carried to summary

### K2 GALANA KULALU GENERATORS ENGINES

<table>
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<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td>Coolant 30lts per unit x 6 gensets</td>
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<td>180</td>
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<tr>
<td>2)</td>
<td>Engine Oil 20lts x 6</td>
<td>Lts</td>
<td>120</td>
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</tr>
<tr>
<td>3)</td>
<td>Oil filter 2 pcs per unit x 6</td>
<td>Pcs</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td>Fuel Filter 2 pcs per unit x 6</td>
<td>Pcs</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5)</td>
<td>Water filters</td>
<td>Pcs</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6)</td>
<td>Air Filters 2 pcs per genset</td>
<td>Pcs</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7)</td>
<td>Battery Water</td>
<td>Pcs</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8)</td>
<td>Margins on parts</td>
<td>Item</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9)</td>
<td>Consumables</td>
<td>Item</td>
<td>1</td>
<td></td>
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<tr>
<td>10)</td>
<td>Accommodation for 6 days for 2 technicians</td>
<td>Days</td>
<td>6</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11)</td>
<td>Transportation of parts from site to Nairobi and Back</td>
<td>Km</td>
<td>850</td>
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</table>

Subtotal Carried to summary

<table>
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<tr>
<th>Item</th>
<th>Description</th>
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<th>Quantity</th>
<th>Unit Cost</th>
<th>Amount (Kshs.) Year 1</th>
<th>Amount (Kshs.) Year 2</th>
</tr>
</thead>
<tbody>
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<td>1</td>
<td>Coolant 10lts per unit x 20 gensets</td>
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<td>Engine Oil 5lts x 20</td>
<td>Lts</td>
<td>100</td>
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</tr>
<tr>
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<td>Oil filter 2 pcs per unit x 20</td>
<td>Pcs</td>
<td>40</td>
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</tr>
<tr>
<td>4</td>
<td>Fuel Filter 2 pcs per unit x 20</td>
<td>Pcs</td>
<td>40</td>
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<tr>
<td>5</td>
<td>Water filters</td>
<td>Pcs</td>
<td>20</td>
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</tr>
<tr>
<td>6</td>
<td>Air Filters 2 pcs per genset</td>
<td>Pcs</td>
<td>40</td>
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</tr>
<tr>
<td>7</td>
<td>Battery Water</td>
<td>Pcs</td>
<td>20</td>
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</tr>
<tr>
<td>8</td>
<td>Margins on parts</td>
<td>Item</td>
<td>%</td>
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<tr>
<td>9</td>
<td>Consumables</td>
<td>Item</td>
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</tr>
<tr>
<td>10</td>
<td>Accommodation for 6 days for 2 technicians</td>
<td>Days</td>
<td>6</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>11</td>
<td>Transportation of parts from site to Nairobi and Back</td>
<td>Km</td>
<td>850</td>
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K3 GALANA KULALU GENERATORS – CENTRE PIVOTS

### SUMMARY OF COSTS

<table>
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<tr>
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<th>Cost Per Visit</th>
<th>No of Visit per Year</th>
<th>Total Cost Year One</th>
<th>Total Cost Year Two</th>
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<tbody>
<tr>
<td>A1</td>
<td>Bura Generators</td>
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<tr>
<td>A2</td>
<td>Bura Pumps</td>
<td>6</td>
<td></td>
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</tr>
<tr>
<td>A3</td>
<td>Bura Water Works</td>
<td>4</td>
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<td></td>
</tr>
<tr>
<td>B1</td>
<td>Hola Pumps</td>
<td>4</td>
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<td></td>
</tr>
<tr>
<td>B2</td>
<td>Hola Generators</td>
<td>4</td>
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<td>C1</td>
<td>Rwambwa Mudembi Scheme</td>
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<tr>
<td>D1</td>
<td>Westkano Scheme(Pumps)</td>
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<td>E1</td>
<td>Ahero Scheme(Pumps)</td>
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<td>E2</td>
<td>Ahero Scheme(Generator)</td>
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<td>F1</td>
<td>Bunyala Scheme</td>
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<td>F2</td>
<td>Sisenye Scheme</td>
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<td>G1</td>
<td>Head Office Generator</td>
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<td>H1</td>
<td>MIAD Generator</td>
<td>3</td>
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<td>I1</td>
<td>Mwea Irrigation Scheme (Generator)</td>
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<td>J1</td>
<td>Usueni Scheme (Pumps)</td>
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<td></td>
</tr>
<tr>
<td>K2</td>
<td>Galana Generators</td>
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<td></td>
</tr>
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<td>K3</td>
<td>Galana Centre pivots</td>
<td>8</td>
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<td>VAT 14%</td>
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<td>Sub-Total</td>
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<td><strong>Grand Total taken to Form of Tender</strong></td>
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</table>
2.0 VARIABLE PRICES

Charge Rates for various activities under the terms of this contract which shall be applied for 
spare parts, repairs and other services provided which are not part of the Maintenance 
Service included in the yearly contract amount (All prices are inclusive of VAT) : -

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Unit</th>
<th>Rate Ksh</th>
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<tbody>
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<td><strong>MANPOWER</strong></td>
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<td>1</td>
<td>Mechanic’s Normal Hourly labour</td>
<td>Ksh/hour</td>
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</tr>
<tr>
<td>2</td>
<td>Mechanic’s Over-time</td>
<td>Ksh/hour</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mechanic’s Per Diem</td>
<td>Kshs/Night</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Electrician’s Normal Hourly labour</td>
<td>Ksh/hour</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Electrician’s Over-time</td>
<td>Ksh/hour</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mechanic’s Per Diem</td>
<td>Kshs/Night</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Non-skilled personnel’s Normal labour</td>
<td>Ksh/hour</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Non-skilled personnel’s Over-time</td>
<td>Ksh/hour</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mechanic’s Per Diem</td>
<td>Kshs/Night</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Transport for personnel and light equipments by 1 ton pick-up (Round trip and local running)</td>
<td>Inspection visit</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Transport using 7-ton truck (Round trip and local running)</td>
<td>Inspection visit</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Operation overheads</td>
<td>Ksh/ Site visit</td>
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### SPARE PARTS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>For spare parts, the yearly manufacturer’s price list will be taken into account multiplied by a coefficient of DUTY: 10 % Freight: 15 % Clearing: 10 % the average exchange rate of the currency at the time of clearing. Margin for profit and Overheads % (to be quoted)</td>
</tr>
</tbody>
</table>

---

**Total Tender Price in Words:**

-------------------------------------------------------------------------------------------------------------------------------------

-------------------------------------------------------------------------------------------------------------------------------------

**Name of Tenderer:**

--------------------------------------------------------------------------------

**Name of the person having the power of attorney:**

--------------------------------------------------------------------------------

**Signature of the person having the power of attorney:**

--------------------------------------------------------------------------------

**Date:**

--------------------------------------------------------------------------------

**Note:** In case of discrepancy between unit price and total, the unit price shall prevail.

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3. **CONTRACT FORM**

THIS AGREEMENT made the day of 20 between [name of Procurement entity] of [country of Procurement entity] (hereinafter called “the Procuring entity”) of the one part and  [name of tenderer] of [city and country of tenderer] (hereinafter called “the tenderer”) of the other part:

WHEREAS the Procuring entity invited tenders for the GPA cover and has accepted a tender by the tenderer for the supply of the services in the sum of [contract price in words in figures] (hereinafter called “the Contract Price”).

NOW THIS AGREEMENT WITNESSTH AS FOLLOWS:-

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

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz:
   (a) the Tender Form and the Price Schedule submitted by the tenderer;
   (b) the Schedule of Requirements
   (c) the Details of cover
   (d) the General Conditions of Contract
   (e) the Special Conditions of Contract; and
   (f) the Procuring entity’s Notification of Award

3. In consideration of the payments to be made by the Procuring entity to the tenderer as hereinafter mentioned, the tenderer hereby covenants with the Procuring entity to provide the GPA cover 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 tenderer in consideration of the provision of the services 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 their respective laws the day and year first above written

Signed, sealed, delivered by _______ the _________ (for the Procuring entity)

Signed, sealed, delivered by _______ the _________ (for the tenderer) in the presence of ______

______________
4. **CONFIDENTIAL BUSINESS QUESTIONNAIRE**

You are requested to give the particular indicated in Part 1 and either Part 2(a), 2(b), or 2(c) whichever applies to your type of business

You are advised that it is a serious offence to give false information on this Form.

Part _______ General:

<table>
<thead>
<tr>
<th>Location of business premises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plot.No........................Street/Road</td>
</tr>
</tbody>
</table>

Postal Address .................... Tel. No. ............Fax ............ Email ............

Nature of business .................................................................

Registration Certificate No. .........................................................

Maximum value of business which you can handle at any one time Kshs.

Name of your bankers............................ Branch ...........................

Part 2(a) – Sole Proprietor:

Your name in full ................................................. Age ..................

Nationality ........................................... Country of origin ...................

Citizenship details.................................................................

Part 2(b) – Partnership

Give details of partners as follows

<table>
<thead>
<tr>
<th>Name</th>
<th>Nationality</th>
<th>Citizenship Details</th>
<th>Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1..........................</td>
<td>..........................</td>
<td>..........................</td>
<td>--------</td>
</tr>
<tr>
<td>2..........................</td>
<td>..........................</td>
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</tr>
<tr>
<td>3..........................</td>
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<tr>
<td>4..........................</td>
<td>..........................</td>
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</tr>
<tr>
<td>5..........................</td>
<td>..........................</td>
<td>..........................</td>
<td>--------</td>
</tr>
</tbody>
</table>

Part 2(c) – Registered Company:

Private or public …………………………………………………………………………………………….

State the nominal and issued capital of the company –

Nominal Kshs. ……………………………………………………………

Issued Kshs…………………………………………………………………….

Give details of all directors as follows

<table>
<thead>
<tr>
<th>Name</th>
<th>Nationality</th>
<th>Citizenship Details</th>
<th>Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1……………………………………………………………………………………………</td>
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<td>2……………………………………………………………………………………………</td>
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<td>3……………………………………………………………………………………………</td>
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<tr>
<td>5……………………………………………………………………………………………</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date……………………………Signature of Tenderer …………………………………..

If a citizen, indicate under “Citizenship Details” whether by Birth, Naturalization or Registration
5. TENDER SECURITY FORM

Whereas [name of Bidder] (hereinafter called <the tenderer>) has submitted its bid dated [date of submission of bid] for the provision of services (hereinafter called <the tender>)

KNOW ALL PEOPLE by these presents that WE [name of bank] of [name of country], having our registered office at [name of procuring entity] (hereinafter called <the procuring entity>) in the sum of [state the amount] for which payment well and truly to be made to the said procuring entity, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this ___________ day of ___________________________ 20 ___

____________

THE CONDITIONS of this obligation are:-

1. If the tenderer withdraws its tender during the period of tender validity specified by the procuring entity on the Form; or

2. If the tender, having been notified of the acceptance of its tender by the procuring entity during the period of tender validity

   (a) fails or refuses to execute the Contract Form, if required; or
   (b) fails or refuses to furnish the performance security, in accordance with the Instructions to tenders.

We undertake to pay to the procuring entity up to the above amount upon receipt of its first written demand, without the procuring entity having to substantiate its demand, provided that in its demand the procuring entity will note that the amount claimed by it is due to it, owing to the occurrence of one or both of the conditions, specifying the occurred condition(s)

This tender guarantee will remain in force up to and including thirty (30) days after the period of tender validity, i.e until (date – 120 days from date of tender opening), and any demand in respect thereof should reach the Bank not later than the above stated date.

[Authorized Signatories and official stamp of the Bank]
6. PERFORMANCE SECURITY FORM

To: …………………………….
[Name of procuring entity]

WHEREAS ……………………………………………. [name of tenderer]
(Hereinafter called “the tenderer”) has undertaken, in pursuance of Contract No. [reference number of the contract] dated 20 to supply
[description of services] (Hereinafter called “the Contract”)

AND WHEREAS it has been stipulated by you in the said Contract that the tenderer shall furnish you with a bank guarantee by a reputable bank for a sum specified therein as security for compliance with the Tenderer’s performance obligations in accordance with the Contract

AND WHEREAS we have agreed to give the tenderer a guarantee:

THERFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the tenderer, up to a total of …………………………… [amount of the guarantee in words and figures], and we undertake to pay you, upon your first written demand declaring the tenderer to be in default under the Contract and without cavil or argument, any sum of money within the limits of ……………………………………………………… [Amount of guarantee] as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the ________________ day of ________________ 20 ___

Signature and seal of the Guarantors

[Name of bank of financial institution]

[Address]

[Date]
7. MANUFACTURER’S AUTHORIZATION FORM

To [name of the Procuring entity] .....................

WHEREAS .................................................................[ name of the manufacturer] who are established and reputable manufacturers of ......................... [name and/or description of the goods] having factories at ........................................ [address of factory] do hereby authorize ........................................ [name and address of Agent] to submit a tender, and subsequently negotiate and sign the Contract with you against tender No. ........................................ [reference of the Tender] for the above goods manufactured by us.

We hereby extend our full guarantee and warranty as per the General Conditions of Contract for the goods offered for supply by the above firm against this Invitation for Tenders.

[signature for and on behalf of manufacturer]

Note: This letter of authority should be on the letterhead of the Manufacturer and should be signed by an authorized person.
8. ANTI CORRUPTION DECLARATION FORM

I/We (Name of the firm) declare that I/We recognize that Public Procurement and Disposal is based on a free and fair competitive tendering process which should not be open to abuse.

I/We……………………………declare that I/We……………………will not offer or facilitate, directly or indirectly, any inducement or reward to any public officer, their relations or business associates, in accordance with the tender No…………………………for or in the subsequent performance of the contract if I/We am/are successful.

Signed by Name: …………………………………………………………………………………

Title/Designation:……………………………………………………………………………………

Date: ……………………………………………………………………………………………
9. LETTER OF NOTIFICATION OF AWARD

Address of Procuring Entity
________________________________________

To: ____________________________
________________________________________
________________________________________

RE: Tender No. _________________________

Tender Name _________________________

This is to notify that the contract/s stated below under the above mentioned tender have been awarded to you.

________________________________________

1. Please acknowledge receipt of this letter of notification signifying your acceptance.

2. The contract/contracts shall be signed by the parties within 30 days of the date of this letter but not earlier than 14 days from the date of the letter.

3. You may contact the officer(s) whose particulars appear below on the subject matter of this letter of notification of award.

(FULL PARTICULARS) ____________________________________________

________________________________________

SIGNED FOR ACCOUNTING OFFICER