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INVITATION TO BID

REHABILITATION OF DAMS AND DUG OUTS IN 10 COMMUNITIES IN THE ADAPTATION FUND DISTRICTS IN THE THREE (3) NORTHERN REGIONS OF GHANA

(LOTS 1-7)

ITB No.: UNDP.GHA.2018.133.WKS

**Project: Increased Resilience to Climate Change in Northern
Ghana through the Management of Water Resources and
Diversification of Livelihoods**

Country: Ghana

Issued on: 4 December 2018

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Section 1. Letter of Invitation

The United Nations Development Programme (UNDP) hereby invites you to submit a Bid to this Invitation to Bid (ITB) for the above-referenced subject.

This ITB includes the following documents and the General Terms and Conditions of Contract which is inserted in the Bid Data Sheet:

- Section 1: This Letter of Invitation
- Section 2: Instruction to Bidders
- Section 3: Bid Data Sheet (BDS)
- Section 4: Evaluation Criteria
- Section 5: Schedule of Requirements and Technical Specifications
- Section 6: Returnable Bidding Forms
 - o Form A: Bid Submission Form
 - o Form B: Bidder Information Form
 - o Form C: Joint Venture/Consortium/Association Information Form
 - o Form D: Qualification Form
 - o Form E: Format of Technical Bid
 - o Form F: BOQ
 - o Form G: Form of Bid Security

If you are interested in submitting a Bid in response to this ITB, please prepare your Bid in accordance with the requirements and procedure as set out in this ITB and submit it by the Deadline for Submission of Bids set out in Bid Data Sheet.

Please acknowledge receipt of this ITB by sending an email to procurement.gh@undp.org, indicating whether you intend to submit a Bid or otherwise. This will enable you to receive amendments or updates to the ITB. Should you require further clarifications, kindly communicate with the contact person/s identified in the attached Data Sheet as the focal point for queries on this ITB.

UNDP looks forward to receiving your Bid and thank you in advance for your interest in UNDP procurement opportunities.

Issued by



Name: Procurement Unit

Title:

Date: **December 4, 2018**

Approved by:



Name: ROKYA YE DIENG

Title: DEPUTY COUNTRY DIRECTOR - OPERATIONS

Date: **December 4, 2018**

Section 2. Instruction to Bidders

GENERAL PROVISIONS	
1. Introduction	<p>1.1 Bidders shall adhere to all the requirements of this ITB, including any amendments made in writing by UNDP. This ITB is conducted in accordance with the UNDP Programme and Operations Policies and Procedures (POPP) on Contracts and Procurement which can be accessed at https://popp.undp.org/SitePages/POPPBSUnit.aspx?TermID=254a9f96-b883-476a-8ef8-e81f93a2b38d</p> <p>1.2 Any Bid submitted will be regarded as an offer by the Bidder and does not constitute or imply the acceptance of the Bid by UNDP. UNDP is under no obligation to award a contract to any Bidder as a result of this ITB.</p> <p>1.3 UNDP reserves the right to cancel the procurement process at any stage without any liability of any kind for UNDP, upon notice to the bidders or publication of cancellation notice on UNDP website.</p> <p>1.4 As part of the bid, it is desired that the Bidder registers at the United Nations Global Marketplace (UNGMP) website (www.ungm.org). The Bidder may still submit a bid even if not registered with the UNGM. However, if the Bidder is selected for contract award, the Bidder must register on the UNGM prior to contract signature.</p>
2. Fraud & Corruption, Gifts and Hospitality	<p>2.1 UNDP strictly enforces a policy of zero tolerance on proscribed practices, including fraud, corruption, collusion, unethical or unprofessional practices, and obstruction of UNDP vendors and requires all bidders/vendors observe the highest standard of ethics during the procurement process and contract implementation. UNDP's Anti-Fraud Policy can be found at http://www.undp.org/content/undp/en/home/operations/accountability/audit/office_of_audit_and_investigation.html#anti</p> <p>2.2 Bidders/vendors shall not offer gifts or hospitality of any kind to UNDP staff members including recreational trips to sporting or cultural events, theme parks or offers of holidays, transportation, or invitations to extravagant lunches or dinners.</p> <p>2.3 In pursuance of this policy, UNDP:</p> <p>(a) Shall reject a bid if it determines that the selected bidder has engaged in any corrupt or fraudulent practices in competing for the contract in question;</p> <p>(b) Shall declare a vendor ineligible, either indefinitely or for a stated period, to be awarded a contract if at any time it determines that the vendor has engaged in any corrupt or fraudulent practices in competing for, or in executing a UNDP contract.</p> <p>2.4 All Bidders must adhere to the UN Supplier Code of Conduct, which may be found at http://www.un.org/depts/ptd/pdf/conduct_english.pdf</p>

3. Eligibility	<p>3.1 A vendor should not be suspended, debarred, or otherwise identified as ineligible by any UN Organization or the World Bank Group or any other international Organization. Vendors are therefore required to disclose to UNDP whether they are subject to any sanction or temporary suspension imposed by these organizations.</p> <p>3.2 It is the Bidder's responsibility to ensure that its employees, joint venture members, sub-contractors, service providers, suppliers and/or their employees meet the eligibility requirements as established by UNDP.</p>
4. Conflict of Interests	<p>4.1 Bidders must strictly avoid conflicts with other assignments or their own interests, and act without consideration for future work. Bidders found to have a conflict of interest shall be disqualified. Without limitation on the generality of the above, Bidders, and any of their affiliates, shall be considered to have a conflict of interest with one or more parties in this solicitation process, if they:</p> <ul style="list-style-type: none"> a) Are or have been associated in the past, with a firm or any of its affiliates which have been engaged by UNDP to provide services for the preparation of the design, specifications, Terms of Reference, cost analysis/estimation, and other documents to be used for the procurement of the goods and services in this selection process; b) Were involved in the preparation and/or design of the programme/project related to the goods and/or services requested under this ITB; or c) Are found to be in conflict for any other reason, as may be established by, or at the discretion of UNDP. <p>4.2 In the event of any uncertainty in the interpretation of a potential conflict of interest, Bidders must disclose to UNDP, and seek UNDP's confirmation on whether or not such conflict exists.</p> <p>4.3 Similarly, the Bidders must disclose in their Bid their knowledge of the following:</p> <ul style="list-style-type: none"> a) If the owners, part-owners, officers, directors, controlling shareholders, of the bidding entity or key personnel who are family members of UNDP staff involved in the procurement functions and/or the Government of the country or any Implementing Partner receiving goods and/or services under this ITB; and b) All other circumstances that could potentially lead to actual or perceived conflict of interest, collusion or unfair competition practices. <p>Failure to disclose such an information may result in the rejection of the Bid or Bids affected by the non-disclosure.</p> <p>4.4 The eligibility of Bidders that are wholly or partly owned by the Government shall be subject to UNDP's further evaluation and review of various factors such as being registered, operated and managed as an independent business entity, the extent of Government ownership/share, receipt of subsidies, mandate and access to information in relation to this ITB, among others. Conditions that may lead to undue advantage against other Bidders may result in the eventual rejection of the Bid.</p>

B. PREPARATION OF BIDS		
5. General Considerations	5.1	In preparing the Bid, the Bidder is expected to examine the ITB in detail. Material deficiencies in providing the information requested in the ITB may result in rejection of the Bid.
	5.2	The Bidder will not be permitted to take advantage of any errors or omissions in the ITB. Should such errors or omissions be discovered, the Bidder must notify the UNDP accordingly.
6. Cost of Preparation of Bid	6.1	The Bidder shall bear all costs related to the preparation and/or submission of the Bid, regardless of whether its Bid is selected or not. UNDP shall not be responsible or liable for those costs, regardless of the conduct or outcome of the procurement process.
7. Language	7.1	The Bid, as well as any and all related correspondence exchanged by the Bidder and UNDP, shall be written in the language (s) specified in the BDS.
8. Documents Comprising the Bid	8.1	The Bid shall comprise of the following documents and related forms which details are provided in the BDS: a) Documents Establishing the Eligibility and Qualifications of the Bidder; b) Technical Bid; c) Priced BOQ; d) Bid Security, if required by BDS; e) Any attachments and/or appendices to the Bid.
9. Documents Establishing the Eligibility and Qualifications of the Bidder	9.1	The Bidder shall furnish documentary evidence of its status as an eligible and qualified vendor, using the Forms provided under Section 6 and providing documents required in those forms. In order to award a contract to a Bidder, its qualifications must be documented to UNDP's satisfaction.
10. Technical Bid Format and Content	10.1	The Bidder is required to submit a Technical Bid using the Standard Forms and templates provided in Section 6 of the ITB.
	10.2	Samples of items, when required as per Section 5, shall be provided within the time specified and unless otherwise specified by the Purchaser, at no expense to the UNDP. If not destroyed by testing, samples will be returned at Bidder's request and expense, unless otherwise specified.
	10.3	When applicable and required as per Section 5, the Bidder shall describe the necessary training programme available for the maintenance and operation of the equipment offered as well as the cost to the UNDP. Unless otherwise specified, such training as well as training materials shall be provided in the language of the Bid as specified in the BDS.
	10.4	When applicable and required as per Section 5, the Bidder shall certify the availability of spare parts for a period of at least five (5) years from date of delivery, or as otherwise specified in this ITB.

11. Price Schedule	<p>11.1 The Price Schedule shall be prepared using the Form provided in Section 6 of the ITB and taking into consideration the requirements in the ITB.</p> <p>11.2 Any requirement described in the Technical Bid but not priced in the Price Schedule, shall be assumed to be included in the prices of other activities or items, as well as in the final total price.</p>
12. Bid Security	<p>12.1 A Bid Security, if required by BDS, shall be provided in the amount and form indicated in the BDS. The Bid Security shall be valid for a minimum of thirty (30) days after the final date of validity of the Bid.</p> <p>12.2 The Bid Security shall be included along with the Bid. If Bid Security is required by the ITB but is not found in the Bid, the offer shall be rejected.</p> <p>12.3 If the Bid Security amount or its validity period is found to be less than what is required by UNDP, UNDP shall reject the Bid.</p> <p>12.4 In the event an electronic submission is allowed in the BDS, Bidders shall include a copy of the Bid Security in their bid and the original of the Bid Security must be sent via courier or hand delivery as per the instructions in BDS.</p> <p>12.5 The Bid Security may be forfeited by UNDP, and the Bid rejected, in the event of any, or combination, of the following conditions:</p> <ul style="list-style-type: none"> a) If the Bidder withdraws its offer during the period of the Bid Validity specified in the BDS, or; b) In the event the successful Bidder fails: <ul style="list-style-type: none"> i. to sign the Contract after UNDP has issued an award; or ii. to furnish the Performance Security, insurances, or other documents that UNDP may require as a condition precedent to the effectivity of the contract that may be awarded to the Bidder. (N/A)
13. Currencies	<p>13.1 All prices shall be quoted in the currency or currencies indicated in the BDS. Where Bids are quoted in different currencies, for the purposes of comparison of all Bids:</p> <ul style="list-style-type: none"> a) UNDP will convert the currency quoted in the Bid into the UNDP preferred currency, in accordance with the prevailing UN operational rate of exchange on the last day of submission of Bids; and b) In the event that UNDP selects a Bid for award that is quoted in a currency different from the preferred currency in the BDS, UNDP shall reserve the right to award the contract in the currency of UNDP's preference, using the conversion method specified above.
14. Joint Venture, Consortium or Association	<p>14.1 If the Bidder is a group of legal entities that will form or have formed a Joint Venture (JV), Consortium or Association for the Bid, they shall confirm in their Bid that : (i) they have designated one party to act as a lead entity, duly vested with authority to legally bind the members of the JV, Consortium or Association jointly and severally, which shall be evidenced by a duly notarized Agreement among the legal entities, and submitted with the Bid; and (ii) if they are awarded the contract, the contract shall be entered into, by and between UNDP and the</p>

designated lead entity, who shall be acting for and on behalf of all the member entities comprising the joint venture.

- 14.2 After the Deadline for Submission of Bid, the lead entity identified to represent the JV, Consortium or Association shall not be altered without the prior written consent of UNDP.
- 14.3 The lead entity and the member entities of the JV, Consortium or Association shall abide by the provisions of Clause 15 herein in respect of submitting only one Bid.
- 14.4 The description of the organization of the JV, Consortium or Association must clearly define the expected role of each of the entities in the joint venture in delivering the requirements of the ITB, both in the Bid and the JV, Consortium or Association Agreement. All entities that comprise the JV, Consortium or Association shall be subject to the eligibility and qualification assessment by UNDP.
- 14.5 A JV, Consortium or Association in presenting its track record and experience should clearly differentiate between:
 - a) Those that were undertaken together by the JV, Consortium or Association; and
 - b) Those that were undertaken by the individual entities of the JV, Consortium or Association.
- 14.6 Previous contracts completed by individual experts working privately but who are permanently or were temporarily associated with any of the member firms cannot be claimed as the experience of the JV, Consortium or Association or those of its members, but should only be claimed by the individual experts themselves in their presentation of their individual credentials
- 14.7 JV, Consortium or Associations are encouraged for high value, multi-sectoral requirements when the spectrum of expertise and resources required may not be available within one firm.

15. Only One Bid

- 15.1 The Bidder (including the individual members of any Joint Venture) shall submit only one Bid, either in its own name or as part of a Joint Venture.
- 15.2 Bids submitted by two (2) or more Bidders shall all be rejected if they are found to have any of the following:
 - a) they have at least one controlling partner, director or shareholder in common; or
 - b) any one of them receive or have received any direct or indirect subsidy from the other/s; or
 - c) they have the same legal representative for purposes of this ITB; or
 - d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about, or influence on the Bid of another Bidder regarding this ITB process;
 - e) they are subcontractors to each other's Bid, or a subcontractor to one Bid also submits another Bid under its name as lead Bidder, or some key personnel proposed to be in the team of one Bidder participates in more

	<p>than one Bid received for this ITB process. This condition relating to the personnel, does not apply to subcontractors being included in more than one Bid.</p>
16. Bid Validity Period	<p>16.1 Bids shall remain valid for the period specified in the BDS, commencing on the Deadline for Submission of Bids. A Bid valid for a shorter period may be rejected by UNDP and rendered non-responsive.</p> <p>16.2 During the Bid validity period, the Bidder shall maintain its original Bid without any change, including the availability of the Key Personnel, the proposed rates and the total price.</p>
17. Extension of Bid Validity Period	<p>17.1 In exceptional circumstances, prior to the expiration of the Bid validity period, UNDP may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing, and shall be considered integral to the Bid.</p> <p>17.2 If the Bidder agrees to extend the validity of its Bid, it shall be done without any change to the original Bid.</p> <p>17.3 The Bidder has the right to refuse to extend the validity of its Bid, in which case, the Bid shall not be further evaluated.</p>
18. Clarification of Bid (from the Bidders)	<p>18.1 Bidders may request clarifications on any of the ITB documents no later than the date indicated in the BDS. Any request for clarification must be sent in writing in the manner indicated in the BDS. If inquiries are sent other than specified channel, even if they are sent to a UNDP staff member, UNDP shall have no obligation to respond or confirm that the query was officially received.</p> <p>18.2 UNDP will provide the responses to clarifications through the method specified in the BDS.</p> <p>18.3 UNDP shall endeavour to provide responses to clarifications in an expeditious manner, but any delay in such response shall not cause an obligation on the part of UNDP to extend the submission date of the Bids, unless UNDP deems that such an extension is justified and necessary.</p>
19. Amendment of Bids	<p>19.1 At any time prior to the deadline of Bid submission, UNDP may for any reason, such as in response to a clarification requested by a Bidder, modify the ITB in the form of an amendment to the ITB. Amendments will be made available to all prospective bidders.</p> <p>19.2 If the amendment is substantial, UNDP may extend the Deadline for submission of Bid to give the Bidders reasonable time to incorporate the amendment into their Bids.</p>
20. Alternative Bids	<p>20.1 Unless otherwise specified in the BDS, alternative Bids shall not be considered. If submission of alternative Bid is allowed by BDS, a Bidder may submit an alternative Bid, but only if it also submits a Bid conforming to the ITB requirements. Where the conditions for its acceptance are met, or justifications are clearly established, UNDP reserves the right to award a contract based on an</p>

	alternative Bid.
	20.2 If multiple/alternative bids are being submitted, they must be clearly marked as "Main Bid" and "Alternative Bid"
21. Pre-Bid Conference	21.1 When appropriate, a pre-bid conference will be conducted at the date, time and location specified in the BDS. All Bidders are encouraged to attend. Non-attendance, however, shall not result in disqualification of an interested Bidder. Minutes of the Bidder's conference will be disseminated on the procurement website and shared by email or on the e-Tendering platform as specified in the BDS. No verbal statement made during the conference shall modify the terms and conditions of the ITB, unless specifically incorporated in the Minutes of the Bidder's Conference or issued/posted as an amendment to ITB.

C. SUBMISSION AND OPENING OF BIDS

22. Submission	<p>22.1 The Bidder shall submit a duly signed and complete Bid comprising the documents and forms in accordance with requirements in the BDS. The Price Schedule shall be submitted together with the Technical Bid. Bid can be delivered either personally, by courier, or by electronic method of transmission as specified in the BDS.</p> <p>22.2 The Bid shall be signed by the Bidder or person(s) duly authorized to commit the Bidder. The authorization shall be communicated through a document evidencing such authorization issued by the legal representative of the bidding entity, or a Power of Attorney, accompanying the Bid.</p> <p>22.3 Bidders must be aware that the mere act of submission of a Bid, in and of itself, implies that the Bidder fully accepts the UNDP General Contract Terms and Conditions.</p>
Hard copy (manual) submission	<p>22.4 Hard copy (manual) submission by courier or hand delivery allowed or specified in the BDS shall be governed as follows:</p> <p>a) The signed Bid shall be marked "Original", and its copies marked "Copy" as appropriate. The number of copies is indicated in the BDS. All copies shall be made from the signed original only. If there are discrepancies between the original and the copies, the original shall prevail.</p> <p>(b) The Technical Bid and Price Schedule must be sealed and submitted together in an envelope, which shall:</p> <ol style="list-style-type: none"> Bear the name of the Bidder; Be addressed to UNDP as specified in the BDS; and Bear a warning not to open before the time and date for Bid opening as specified in the BDS. <p>If the envelope with the Bid is not sealed and marked as required, UNDP shall assume no responsibility for the misplacement, loss, or premature opening of the Bid.</p>

Email and eTendering submissions	<p>22.5 Electronic submission through email or eTendering, if allowed as specified in the BDS, shall be governed as follows:</p> <ul style="list-style-type: none"> a) Electronic files that form part of the Bid must be in accordance with the format and requirements indicated in BDS; b) Documents which are required to be in original form (e.g. Bid Security, etc.) must be sent via courier or hand delivered as per the instructions in BDS. <p>22.6 Detailed instructions on how to submit, modify or cancel a bid in the eTendering system are provided in the eTendering system Bidder User Guide and Instructional videos available on this link: http://www.undp.org/content/undp/en/home/operations/procurement/business/procurement-notices/resources/</p>
23. Deadline for Submission of Bids and Late Bids	<p>23.1 Complete Bids must be received by UNDP in the manner, and no later than the date and time, specified in the BDS. UNDP shall only recognise the actual date and time that the bid was received by UNDP</p> <p>23.2 UNDP shall not consider any Bid that is received after the deadline for the submission of Bids.</p>
24. Withdrawal, Substitution, and Modification of Bids	<p>24.1 A Bidder may withdraw, substitute or modify its Bid after it has been submitted at any time prior to the deadline for submission.</p> <p>24.2 Manual and Email submissions: A bidder may withdraw, substitute or modify its Bid by sending a written notice to UNDP, duly signed by an authorized representative, and shall include a copy of the authorization (or a Power of Attorney). The corresponding substitution or modification of the Bid, if any, must accompany the respective written notice. All notices must be submitted in the same manner as specified for submission of Bids, by clearly marking them as "WITHDRAWAL," "SUBSTITUTION," or "MODIFICATION"</p> <p>24.3 eTendering: A Bidder may withdraw, substitute or modify its Bid by Cancelling, Editing, and re-submitting the Bid directly in the system. It is the responsibility of the Bidder to properly follow the system instructions, duly edit and submit a substitution or modification of the Bid as needed. Detailed instructions on how to cancel or modify a Bid directly in the system are provided in the Bidder User Guide and Instructional videos.</p> <p>24.4 Bids requested to be withdrawn shall be returned unopened to the Bidders (only for manual submissions), except if the bid is withdrawn after the bid has been opened.</p>
25. Bid Opening	<p>25.1 UNDP will open the Bid in the presence of an ad-hoc committee formed by UNDP of at least two (2) members.</p> <p>25.2 The Bidders' names, modifications, withdrawals, the condition of the envelope labels/seals, the number of folders/files and all other such other details as UNDP may consider appropriate, will be announced at the opening. No Bid shall be rejected at the opening stage, except for late submissions; in which case, the Bid shall be returned unopened to the Bidders.</p>

- 25.3 In the case of e-Tendering submission, bidders will receive an automatic notification once the Bid is opened.

D. EVALUATION OF BIDS

26. Confidentiality	<p>26.1 Information relating to the examination, evaluation, and comparison of Bids, and the recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process, even after publication of the contract award.</p> <p>26.2 Any effort by a Bidder or anyone on behalf of the Bidder to influence UNDP in the examination, evaluation and comparison of the Bids or contract award decisions may, at UNDP's decision, result in the rejection of its Bid and may subsequently be subject to the application of prevailing UNDP's vendor sanctions procedures.</p>
27. Evaluation of Bids	<p>27.1 UNDP will conduct the evaluation solely on the basis of the Bids received.</p> <p>27.2 Evaluation of Bids shall be undertaken in the following steps:</p> <ul style="list-style-type: none"> a) Preliminary Examination including Eligibility b) Arithmetical check and ranking of bidders who passed preliminary examination by price. c) Qualification assessment (if pre-qualification was not done) a) Evaluation of Technical Bids b) Evaluation of prices <p>Detailed evaluation will be focussed on the 3 - 5 lowest priced bids. Further higher priced bids shall be added for evaluation if necessary</p>
28. Preliminary Examination	<p>28.1 UNDP shall examine the Bids to determine whether they are complete with respect to minimum documentary requirements, whether the documents have been properly signed, and whether the Bids are generally in order, among other indicators that may be used at this stage. UNDP reserves the right to reject any Bid at this stage.</p>
29. Evaluation of Eligibility and Qualification	<p>29.1 Eligibility and Qualification of the Bidder will be evaluated against the Minimum Eligibility/Qualification requirements specified in the Section 4 (Evaluation Criteria).</p> <p>29.2 In general terms, vendors that meet the following criteria may be considered qualified:</p> <ul style="list-style-type: none"> a) They are not included in the UN Security Council 1267/1989 Committee's list of terrorists and terrorist financiers, and in UNDP's ineligible vendors' list; b) They have a good financial standing and have access to adequate financial resources to perform the contract and all existing commercial commitments; c) They have the necessary similar experience, technical expertise, production capacity, quality certifications, quality assurance procedures and other resources applicable to the supply of goods and/or services required; d) They are able to comply fully with the UNDP General Terms and Conditions of Contract; e) They do not have a consistent history of court/arbitral award decisions

	<p>against the Bidder; and</p> <p>f) They have a record of timely and satisfactory performance with their clients.</p>
30. Evaluation of Technical Bid and prices	30.1 The evaluation team shall review and evaluate the Technical Bids on the basis of their responsiveness to the Schedule of Requirements and Technical Specifications and other documentation provided, applying the procedure indicated in the BDS and other ITB documents. When necessary, and if stated in the BDS, UNDP may invite technically responsive bidders for a presentation related to their technical Bids. The conditions for the presentation shall be provided in the bid document where required.
31. Due diligence	<p>31.1 UNDP reserves the right to undertake a due diligence exercise, aimed at determining to its satisfaction, the validity of the information provided by the Bidder. Such exercise shall be fully documented and may include, but need not be limited to, all or any combination of the following:</p> <ul style="list-style-type: none"> a) Verification of accuracy, correctness and authenticity of information provided by the Bidder; b) Validation of extent of compliance to the ITB requirements and evaluation criteria based on what has so far been found by the evaluation team; c) Inquiry and reference checking with Government entities with jurisdiction on the Bidder, or with previous clients, or any other entity that may have done business with the Bidder; d) Inquiry and reference checking with previous clients on the performance on on-going or completed contracts, including physical inspections of previous works, as deemed necessary; e) Physical inspection of the Bidder's offices, branches or other places where business transpires, with or without notice to the Bidder; f) Other means that UNDP may deem appropriate, at any stage within the selection process, prior to awarding the contract.
32. Clarification of Bids	<p>32.1 To assist in the examination, evaluation and comparison of Bids, UNDP may, at its discretion, request any Bidder for a clarification of its Bid.</p> <p>32.2 UNDP's request for clarification and the response shall be in writing and no change in the prices or substance of the Bid shall be sought, offered, or permitted, except to provide clarification, and confirm the correction of any arithmetic errors discovered by UNDP in the evaluation of the Bids, in accordance with the ITB.</p> <p>32.3 Any unsolicited clarification submitted by a Bidder in respect to its Bid, which is not a response to a request by UNDP, shall not be considered during the review and evaluation of the Bids.</p>
33. Responsiveness of Bid	<p>33.1 UNDP's determination of a Bid's responsiveness will be based on the contents of the bid itself. A substantially responsive Bid is one that conforms to all the terms, conditions, specifications and other requirements of the ITB without material deviation, reservation, or omission.</p> <p>33.2 If a bid is not substantially responsive, it shall be rejected by UNDP and may not subsequently be made responsive by the Bidder by correction of the material</p>

	deviation, reservation, or omission.
34. Nonconformities, Reparable Errors and Omissions	<p>34.1 Provided that a Bid is substantially responsive, UNDP may waive any non-conformities or omissions in the Bid that, in the opinion of UNDP, do not constitute a material deviation.</p> <p>34.2 UNDP may request the Bidder to submit the necessary information or documentation, within a reasonable period, to rectify nonmaterial nonconformities or omissions in the Bid related to documentation requirements. Such omission shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.</p> <p>34.3 For the bids that have passed the preliminary examination, UNDP shall check and correct arithmetical errors as follows:</p> <ul style="list-style-type: none"> a) if there is a discrepancy between the unit price and the line item total that is obtained by multiplying the unit price by the quantity, the unit price shall prevail and the line item total shall be corrected, unless in the opinion of UNDP there is an obvious misplacement of the decimal point in the unit price; in which case, the line item total as quoted shall govern and the unit price shall be corrected; b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail. <p>34.4 If the Bidder does not accept the correction of errors made by UNDP, its Bid shall be rejected.</p>

E. AWARD OF CONTRACT

35. Right to Accept, Reject, Any or All Bids	35.1 UNDP reserves the right to accept or reject any bid, to render any or all of the bids as non-responsive, and to reject all Bids at any time prior to award of contract, without incurring any liability, or obligation to inform the affected Bidder(s) of the grounds for UNDP's action. UNDP shall not be obliged to award the contract to the lowest priced offer.
36. Award Criteria	36.1 Prior to expiration of the period of Bid validity, UNDP shall award the contract to the qualified and eligible Bidder that is found to be responsive to the requirements of the Schedule of Requirements and Technical Specification, and has offered the lowest price.
37. Debriefing	37.1 In the event that a Bidder is unsuccessful, the Bidder may request for a debriefing from UNDP. The purpose of the debriefing is to discuss the strengths and weaknesses of the Bidder's submission, in order to assist the Bidder in improving its future Bids for UNDP procurement opportunities. The content of other Bids and how they compare to the Bidder's submission shall not be discussed.

38. Right to Vary Requirements at the Time of Award	38.1 At the time of award of Contract, UNDP reserves the right to vary the quantity of goods and/or services, by up to a maximum twenty-five per cent (25%) of the total offer, without any change in the unit price or other terms and conditions.
39. Contract Signature	39.1 Within fifteen (15) days from the date of receipt of the Contract, the successful Bidder shall sign and date the Contract and return it to UNDP. Failure to do so may constitute sufficient grounds for the annulment of the award, and forfeiture of the Bid Security, if any, and on which event, UNDP may award the Contract to the Second highest rated or call for new Bids.
40. Contract Type and General Terms and Conditions	40.1 The types of Contract to be signed and the applicable UNDP Contract General Terms and Conditions, as specified in BDS, can be accessed at http://www.undp.org/content/undp/en/home/procurement/business/how-we-buy.html
41. Performance Security	41.1 A performance security, if required in the BDS, shall be provided in the amount specified in BDS and form available at https://popp.undp.org/layouts/15/WopiFrame.aspx?sourcedoc=/UNDP_POPP_DOCUMENT_LIBRARY/Public/PSU_Solicitation_Performance%20Guarantee%20Form.docx&action=default within a maximum of fifteen (15) days of the contract signature by both parties. Where a performance security is required, the receipt of the performance security by UNDP shall be a condition for rendering the contract effective.
42. Bank Guarantee for Advanced Payment	42.1 Except when the interests of UNDP so require, it is UNDP's standard practice to not make advance payment(s) (i.e., payments without having received any outputs). If an advance payment is allowed as per the BDS, and exceeds 20% of the total contract price, or USD 30,000, whichever is less, the Bidder shall submit a Bank Guarantee in the full amount of the advance payment in the form available at https://popp.undp.org/layouts/15/WopiFrame.aspx?sourcedoc=/UNDP_POPP_DOCUMENT_LIBRARY/Public/PSU_Contract%20Management%20Payment%20and%20Taxes_Advanced%20Payment%20Guarantee%20Form.docx&action=default
43. Liquidated Damages	43.1 If specified in the BDS, UNDP shall apply Liquidated Damages for the damages and/or risks caused to UNDP resulting from the Contractor's delays or breach of its obligations as per Contract.
44. Payment Provisions	44.1 Payment will be made only upon UNDP's acceptance of the goods and/or services performed. The terms of payment shall be within thirty (30) days, after receipt of invoice and certification of acceptance of goods and/or services issued by the proper authority in UNDP with direct supervision of the Contractor. Payment will be effected by bank transfer in the currency of the contract.
45. Vendor Protest	45.1 UNDP's vendor protest procedure provides an opportunity for appeal to those persons or firms not awarded a contract through a competitive procurement process. In the event that a Bidder believes that it was not treated fairly, the

following link provides further details regarding UNDP vendor protest procedures:

<http://www.undp.org/content/undp/en/home/procurement/business/protest-and-sanctions.html>

46. Other Provisions

- 46.1 In the event that the Bidder offers a lower price to the host Government (e.g. General Services Administration (GSA) of the federal government of the United States of America) for similar goods and/or services, UNDP shall be entitled to the same lower price. The UNDP General Terms and Conditions shall have precedence.
- 46.2 UNDP is entitled to receive the same pricing offered by the same Contractor in contracts with the United Nations and/or its Agencies. The UNDP General Terms and Conditions shall have precedence.
- 46.3 The United Nations has established restrictions on employment of (former) UN staff who have been involved in the procurement process as per bulletin ST/SGB/2006/15
[http://www.un.org/en/ga/search/view_doc.asp?symbol=ST/SGB/2006/15&refer](http://www.un.org/en/ga/search/view_doc.asp?symbol=ST/SGB/2006/15&referer)
[er](http://www.un.org/en/ga/search/view_doc.asp?symbol=ST/SGB/2006/15&referer)

Section 3. Bid Data Sheet

The following data for the goods and/or services to be procured shall complement, supplement, or amend the provisions in the Invitation to Bid. In the case of a conflict between the Instructions to Bidders, the Bid Data Sheet, and other annexes or references attached to the Bid Data Sheet, the provisions in the Bid Data Sheet shall prevail.

BDS No.	Ref. to Section.2	Data	Specific Instructions / Requirements
1	7	Language of the Bid	English
2		Submitting Bids for Parts or sub-parts of the Schedule of Requirements (partial bids)	Allowed Bidders are Allowed to submit partial bids per complete LOT
3	20	Alternative Bids	Shall not be considered
4	21	Pre-Bid conference	Will be Conducted Time: 10:00am Date: December 11, 2018 10:00 AM Venue: UNDP Conference Hall Address: UNDP Premises The UNDP focal point for the arrangement is: E-mail: procurement.gh@undp.org
5	16	Bid Validity Period	120 days
6	13	Bid Security / bid bond Required	USD 3,000 per Lot or its GHS Equivalent Bidders submitting bids for more than one lot <u>must</u> submit a separate bid security for each lot.
7	41	Advanced Payment upon signing of contract	Not Allowed

8	42	Liquidated Damages	Will be imposed as follows: Percentage of contract price per day of delay: 0.5% Max. number of days of delay 30days, after which UNDP may terminate the contract.
9	40	Performance Security/ bond	Required in the amount of (10%) of the contract value <i>The performance security shall be returned to the Contractor within 30 days after the completion of the contract, including any warranty obligations or defects liability period as may be agreed in the contract.</i>
10	12	Currency of Bid	United States Dollar
11	31	Deadline for submitting requests for clarifications/ questions	3 days before the submission deadline
12	31	Contact Details for submitting clarifications/questions	Focal Person in UNDP: ROKYA YE DIENG (DCD-O) Address: United Nations Development Programme UN House No. 27 Ring Road East (Near Fire Services HQ) Accra, Ghana E-mail: procurement.gh@undp.org
13	18, 19 and 21	Manner of Disseminating Supplemental Information to the ITB and responses/clarifications to queries	Direct communication to prospective Proposers by email and Posting on the website.
14	23	Deadline for Submission	Date and Time: 20th December 2018, at 10:30am
14	22	Allowable Manner of Submitting Bids	<input checked="" type="checkbox"/> Submission by email only to gh.bids@one.un.org

15	22	Bid Submission Address	gh.bids@one.un.org
16	22	Electronic submission (email) requirements	<ul style="list-style-type: none"> ▪ Format: PDF files only ▪ File names must be maximum 60 characters long and must not contain any letter or special character other than from Latin alphabet/keyboard. ▪ All files must be free of viruses and not corrupted. ▪ Max. File Size per transmission: (9MG) ▪ Mandatory subject of email: UNDP.GHA.2018.133.WKS – Rehabilitation of Dam and Dugouts – (Lot ...) ▪ Documents which are required in original should be sent to the below address with a PDF copy submitted as part of the electronic submission: Focal Person in UNDP: ROKYA YE DIENG (DCD-O) Address: United Nations Development Programme UN House No. 27 Ring Road East (Near Fire Services HQ) Accra, Ghana
17	25	Date, time and venue for the opening of bid	<p>Date and Time: December 20, 2018 11:00 AM</p> <p>Venue: UNDP Conference Hall</p> <p>Bids will be opened in the presence of the Bidders' representatives who choose to attend</p>
18	27, 36	Evaluation Method for the Award of Contract	Lowest priced technically responsive, eligible and qualified bids.
19		Expected date for commencement of Contract	January 15, 2019
20		Maximum expected duration of contract	Six (6) Months
21	35	UNDP will award the contract to:	<p>One or more Proposers, depending on the following factors</p> <p><input checked="" type="checkbox"/> Bidders can submit a bid for one Lot or multiple Lots.</p> <p><input checked="" type="checkbox"/> Bidders will be awarded not more than two lots should they win more than two (2) lots</p> <p>Determination of award for the Lots in such a scenario would be</p>

based on the following criteria:

- 1) Overall least price combination across Lots to UNDP based on different combinations of award.
- 2) Preference to award a Lot to a bidder in the event that there may not be other technically responsive bids for that Lot to ensure there is coverage for all Lots.
- 3) Irrespective of determined capacity to undertake more than 1 lot, UNDP may decide at its discretion to award Lots to different bidders to reduce risk of delivery.

22	39	Type of Contract	Contract for Civil Works http://www.undp.org/content/undp/en/home/procurement/business/how-we-buy.html
23	39	UNDP Contract Terms and Conditions that will apply	UNDP General Terms and Conditions for Works http://www.undp.org/content/undp/en/home/procurement/business/how-we-buy.html
24		Other Information Related to the ITB Link for the Engineering Drawings	https://www.dropbox.com/sh/v8vykodhp0wvzb1/AACGMbC6rbJC_HtHMyUVPq1pPa?dl=0

Section 4. Evaluation Criteria

Preliminary Examination Criteria

Bids will be examined to determine whether they are complete and submitted in accordance with ITB requirements as per below criteria on a Yes/No basis:

- Duly Signed Forms A, B, C, D, E and F.
- Bid Form Signed by Authorized Person (s)
- Written Power of Attorney
- Bid Validity of 120 days
- Priced Bills of Quantities
- Certificate of Registration of the business, including Articles of Incorporation, or equivalent document if Bidder is not a corporation
- Certificate to commence business
- Works and Housing Certificate – D1/K1 & D2/K2 licenses and Highest certificate value under Enterprise Category
- List of Equipment
- Valid Audited Financial Statement
- Bidder Information Sheet fill and completed
- Bidder's Proposed Key Personnel
- Construction Experiences (General, Similar and Specific)

Minimum Eligibility and Qualification Criteria

Eligibility and Qualification will be evaluated on a compliance basis.

If the Bid is submitted as a Joint Venture/Consortium/Association, each member should meet the minimum criteria, unless otherwise specified.

Subject	Criteria	Document Submission requirement
ELIGIBILITY		
Legal Status	Vendor is a legally registered entity.	Form B: Bidder Information Form
Eligibility	Vendor is not suspended, nor debarred, nor otherwise identified as ineligible by any UN Organization or the World Bank Group or any other international Organization in accordance with ITB clause 3.	Form A: Bid Submission Form
Conflict of Interest	No conflicts of interest in accordance with ITB clause 4.	Form A: Bid Submission Form
Bankruptcy	Has not declared bankruptcy, is not involved in bankruptcy or receivership proceedings, and	Form A: Bid

	there is no judgment or pending legal action against the vendor that could impair its operations in the foreseeable future.	Submission Form
Certificates and Licenses	<ul style="list-style-type: none"> ▪ Duly authorized to act as Agent on behalf of the Manufacturer, or Power of Attorney, if bidder is not a manufacturer ▪ Official appointment as local representative, if Bidder is submitting a Bid on behalf of an entity located outside the country ▪ Patent Registration Certificates, if any of technologies submitted in the Bid is patented by the Bidder 	Form B: Bidder Information Form
QUALIFICATION		
History of Non-Performing Contracts¹	Non-performance of a contract did not occur as a result of contractor default for the last 3 years.	Form D: Qualification Form
Litigation History	No consistent history of court/arbitral award decisions against the Bidder for the last 3 years.	Form D: Qualification Form
Previous Experience	Preferred Minimum 5 years of relevant experience.	Form D: Qualification Form
	Preferred Minimum two contracts of similar value, nature and complexity implemented over the last 5 years. (For JV/Consortium/Association, all Parties cumulatively should meet requirement).	Form D: Qualification Form
Financial Standing	Minimum average annual turnover of USD 200,000 or its equivalent in GHS for the last 3 years per lot Tendered (For JV/Consortium/Association, all Parties cumulatively should meet requirement).	Form D: Qualification Form
	Bidder must demonstrate the current soundness of its financial standing and indicate its prospective long-term profitability. (For JV/Consortium/Association, all Parties cumulatively should meet requirement).	Form D: Qualification Form

¹ Non-performance, as decided by UNDP, shall include all contracts where (a) non-performance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Non-performance shall not include contracts where Employers' decision was overruled by the dispute resolution mechanism. Non-performance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

Detailed Technical and Financial Evaluation

TECHNICAL EVALUATION

Technical Evaluation

The technical bids shall be evaluated on for compliance or non-compliance with the technical specifications identified below.

Form E:
Technical Bid
Form

Bids which fulfil the full requirements of Preliminary shall be considered Substantially Responsive. Only substantially responsive bids will progress to Stage II for Detailed Examination below.

Stage II: Detailed Examination of Bids

(a) Technical Compliance

- Compliance with requirements in the BOQ/Statement of works
- Environmental and Social Impact Document
- Method Statement
- Construction / Work Schedule
- Construction Equipment details
- CVs of Key Personnel

FINANCIAL EVALUATION

Financial Evaluation

Detailed analysis of the price schedule based on requirements listed in Section 5 and quoted for by the bidders in Form F.

Form F: BOQ
Form

Financial Examination of Bids and comparison of Bids after Arithmetic checks of the BOQs

(b) Financial Examination of Bids

- Submitted and Corrected Bid Prices and Errors
- Evaluated Bid Prices

Post Qualification Examination

Stage III: Qualification Assessment

- Qualification Assessment Summary
- Historical Financial Performance
- Annual Construction Turnover
- Financial Resources
- General Construction Experience
- Similar Construction Experience
- Specific Construction Experience

Section 5. STATEMENT OF WORK / Schedule of Requirements

1. Scope of Works

The Scope of Works will consist of the construction of the following;

1.1 Earthen dam wall with appurtenant structures

- Embankment- The dam wall which is sited across the valley to impound water.
- Key Trench- This provides the stability, the keying and reduces seepage through the dam body.

1.2 WATER DELIVERY SYSTEM

- Inlet/Outlet conduit pipe-It was designed to be 300mm PVC / PN pipe.
- Chambers for Inlet and Outlet- Concrete chambers to connect the conduit pipes for water delivery to the downstream of the dam.
- Sluice Valve-300mm metal valve to regulate the water flow from the reservoir and onto the fields.

1.3 Components of Spillway

- Concrete control structure
- Earthen Channel
- Boulder packs as energy dissipaters
- Stone pitching for slope stability

1.4 REHABILITATION OF DAMS AND DUGOUTS IN NORTHERN GHANA

PRINCIPAL QUANTITIES

LOT	Project Name	Earthworks (Excavation) m ³	Earthworks (Fill) m ³	Spillway Length m	Concrete volume m ³	Reserior Volume m ³
LOT1	REHABILITATION OF IRRIGATION DAM AT TAMALUGU	9,550.0	8,000.0	25	100	681,690.0

LOT2	REHABILITATION OF IRRIGATION DAM AT ADABOYA	13,600.0	11,600.0	20	89	304,325.0
LOT3	REHABILITATION OF IRRIGATION DAM AT LAMBOYA	13,450.0	12,800.0	20	234	828,935.0
LOT4	REHABILITATION OF IRRIGATION DAM AT KESIESA & TAMPION	15,710.0	14,388.0	50	120	664,424.0
LOT5	REHABILITATION OF IRRIGATION DAM AT KO-GBAFIO, GOLI & KASEASE	9,330.0	9,180.0	75	360	537,309.0
LOT6	REHABILITATION OF DUGOUT AT BUGUBELLE	2,987.0	2,987.0	12	7	37,295.0
LOT7	REHABILITATION OF IRRIGATION DAM AT TAKPO	7,400.0	6,075.0	30	15	217,591.0

2. Technical Specification

GENERAL SPECIFICATION

Scope of Works

The Works consist of:

- a. Construction of an Earth Dam
- b. Spillway Control Structure

Workmanship and Materials in General

(1) All workmanship shall be of the best quality appropriate to each category of work. Except where otherwise stated or approved by the Project Manager, all materials used in the Works shall be of the best quality of their respective kinds as specified or described in the Specification, Drawings and Bills of Quantities and shall comply wherever possible with the current issue of the appropriate standard published by the American National Standards Institute (ANSI), the American Society for Testing and materials (ASTM), the American Welding Society (AWS), the British Standards

Institution (BSI), the International Standard Organization (ISO) or other equivalent national standard proposed by the Contractor and approved by the Project Manager.

(2) Reference to any specific standards in the Specification or Bills of Quantities does not imply any bias in favor of equipment, fittings, finishing, etc, but is intended to indicate the standard acceptable to the Project Manager. The Contractor may relate his offer to other National Standards or Codes of Practice, but shall explain the system used and provide the Project Manager with all the necessary information and comparisons in English showing that his proposed standards are equivalent to the specified standards.

(3) In all cases where the name of a particular type or make of equipment or item is referred to on the Drawings or elsewhere in this Specification, this is intended to indicate only the acceptable standard.

(4) The Contractor shall use locally produced materials in preference to imported materials provided that they comply with the Specification and are available in sufficient and timely quantities.

Materials On and Under the Site

All soil, turf, gravel, stone, timber, or other materials obtained in the excavations, clearing of the Site of the Works and soil stripping shall belong to the Employer and must not be removed from the Site without the consent of the Project Manager. The Contractor, however, may use for the construction of the Works timber felled on the Site and any of the materials excavated under the Contract, which the Project Manager may determine to be fit for such use and shall use such materials if directed by the Project Manager.

Sufficiency of Means Employed

The Contractor shall take upon himself the full and entire responsibility for the sufficiency of the scaffolding, timbering, machinery, tools or implements and generally for all means used for the fulfillment of the Contract. In the event of any of these means proving insufficient the Contractor is still fully and entirely responsible for the sufficiency of these means notwithstanding any previous

approval or recommendation that may have been given by the Project Manager.

Interference with Existing Works

The Contractor shall not interfere in any way with any existing works whether the property of the Employer or of a third party and whether the position of such works is indicated to the Contractor by the Project Manager or not, except where such interference is specifically described as part of the Works either in the Contract or in the Project Manager's instructions.

Water Supply

The Contractor shall provide an adequate supply of safe drinking water on the Site. The quality, number, capacity and location of the installations shall be to the satisfaction of the Project Manager.

Restoration of Drains, Streams, Canals, etc.

- (1) The Contractor shall ensure that during the construction of the Works, the flow in rivers and existing channels and pipelines are not interrupted or diverted without the prior approval of the Project Manager. Where in the execution of the Works, the Contractor finds it necessary to interrupt or divert such supplies, he shall first submit details to the Project Manager of the date or dates the supply will be affected and the measures he is proposing to maintain a temporary supply.
- (2) The Contractor may, unless directed otherwise by the Project Manager, extract a reasonable quantity of water from rivers and existing channels flowing adjacent to or through the Site for the execution of the Works. Where the Contractor is not permitted, for whatever reason, to extract water from the aforesaid sources, he shall make arrangements to draw water from some other approved source.
- (3) Subject to any requirement of the Works whereby a permanent change is to be effected, all drains, canals, pipes, channels, watercourse 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. Reinstatement of diversion channels shall be such that the land can revert to its former use and suitable protection provided at the upstream junction of the diversion channel and the river such that erosion by the river shall not allow it to bypass the new permanent works.

Fences

(1) The Contractor shall construct and maintain at his own expense suitable and approved temporary fencing to enclose such areas of the Works to be carried out and all areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under Clause 21 of Section 3 of "Conditions of Contract". Where any temporary fence has to be constructed alongside a public road, a footpath, a canal, etc., it shall be to the satisfaction of the authority concerned.

(2) The Contractor shall fence his housing and other compounds in an approved manner so as to exclude all wild or stray animals.

(3) Fences crossed by the Works and forming boundaries of plots outside the area occupied by the Works shall not be cut through or destroyed for more than the distance necessary to permit the erection of new fencing, etc, and the Contractor shall make the ends of the cut fences secure.

Contractor's Accommodation

The Employer will provide, free of charge, the areas of land where the Contractor shall establish the office, housing, plant yard/stores, accommodation and camp for himself and his employees. The Contractor shall provide, erect, serve and maintain all necessary buildings as offices, housing or plant/stores for himself, his staff and his employees. These buildings shall, from the time of their construction until the completion of the Contract, be the property of the Employer and the Contractor shall not demolish or remove any buildings or part of any buildings or part of any buildings without the written permission of the Project Manager.

Contractor's Transport

The Contractor shall make his own arrangements for the transport, where necessary, of his staff and workmen to and from the site of the Works.

Sanitation

The Contractor is to arrange for a standard of sanitation, required by local regulations, to be maintained throughout the Works and housing, office and workshop/plant yard areas. He shall construct and maintain at his own cost a system of surface drainage and waste disposal, which shall be approved by the Project Manager before any work commences. Sanitary conveniences for the use of persons employed in the Works shall be provided and maintained by the Contractor in accordance with the appropriate regulations to the extent and in such a manner and at such places as may be approved by the Project Manager, and all persons connected with the Works shall be obliged to use them.

Medical Arrangements

(1) The Contractor shall make arrangements for treatment on the Site of casualties and sick persons in first-aid units or in such other wards as may be necessary in accordance with the appropriate regulations.

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

Acquisition of Contractor's and Project Manager's Facilities

Notwithstanding the obligation of the Contractor to remove all temporary facilities, the Employer reserves the right to acquire some or all of the above facilities at rates and prices to be negotiated.

Surveying Equipment

The Contractor shall provide chainmen, tradesmen, technicians or labourers to assist the Project Manager in carrying out his duties. The Contractor shall provide, maintain, service and replace as necessary the following surveying equipment for the sole use of the Project Manager and Employer and their staff:

- (i) One total survey station system, complete with two single prisms plus holders and all other accessories;
- (ii) One automatic or quick set dumpy level, complete with accessories;
- (iii) Two 4m metric staffs, with 1cm graduations;
- (iv) Six ranging rods; and
- (v) Three metric measuring tapes, 50m, 10m and 3m long.

Project Manager's Staff Accommodation and Offices

(1) The contractor shall design, construct, furnish and maintain a suitable temporary site office made with wooden, steel or block material, comprising one office measuring 20 sq.m, a verandah (10 sq.m), and a toilet/washroom.

(2) The Contractor shall design, construct, furnish and maintain a suitable temporary house made with wooden, steel or block material for accommodation at the Site for the Project Manager's staff with the following spaces:

- (i) Living/dinning room (10 sq.m)
- (ii) Fitted kitchen (8 sq.m)
- (iii) One double bedroom (9 sq.m)
- (iv) Two single bedrooms (8 sq.m each)
- (v) One bathroom/toilet.

(3) The contractor shall submit to the Project Manager for his approval, detailed drawings of the site office and house together with a list of the furniture and fittings he intends to provide for each building. The Contractor shall also provide and maintain a water supply and sewerage system to each building, and where electricity is available the buildings shall be wired and connected to the supply, though the occupier's would be responsible for paying their own monthly electricity bills.

(4) The Contractor shall erect a 1.8 m high fence including an entrance gate around the perimeter of the housing/office area.

Project Manager's Testing Laboratory

- (1) The Contractor shall provide, equip and maintain for the Project Manager's use a testing laboratory at the Site. The laboratory and the equipment shall be removed and the site reinstated by the Contractor at the end of the Contract.
- (2) The Contractor shall provide all necessary labour and laboratory technicians required by the Project Manager for the efficient running of the laboratory for the purpose of controlling the quality of materials used in the works, but the management of the laboratory shall be by the Project Manager.
- (3) The Contractor shall make arrangements for carrying out tests which cannot be carried out in the site laboratory, at an approved testing laboratory.
- (4) 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.
- (5) The Contractor is required to maintain at the project site in good working order that the following minimum equipment at all times during the contract period:
 - (i) A complete set of BS sieves of 200 or 250mm diameter frames including cover, pan and brush;
 - (ii) One pan type weighing scale complete with weights to weigh up to 10 kg with a sensitivity of 1g;
 - (iii) One slump test cone apparatus complete with standard tamping rod and steel base plate;
 - (iv) Six (6) steel 152mm (6 inches) cube moulds, complete with two (2) tamping rods, base plates and trowels;
 - (v) One (1) set of Portable concrete test machine;
 - (vi) One chemical balance to weigh up to 250g with weight box and sensitivity of 0.1g;
 - (vii) 50 kg of clean, air-dry uniformly graded sand passing a No.16 sieve and retained on 1 No. 30 sieve;

- (viii) One sand-cone apparatus comprising glass jars metal funnel, base plate and spatula for determination of field density;
- (ix) One (1) set of soil compaction test set including the mold, rammer, extruder, straight edge and five (5) pans;
- (x) One set of electrical/gas oven with the inside dimensions, 600 x 700 x 500 mm
- (xi) Three (3) glass graduated cylinders of 1 litre capacity;
- (xii) Three (3) thermometers with a range of zero to 100°C; and
- (xiii) Twelve (12) moisture cans with airtight lids, 100mm diameter and 25 mm deep for moisture content determination of soil samples.

As Constructed Drawings

- (1) During the course of the works, the Contractor shall maintain a fully detailed record of all changes from the tender drawings to facilitate easy and accurate preparation of the “As constructed drawings” and to ensure that these drawings are in all respects a true record of the installation.
- (2) The drawings shall show the complete installation of the Works. The scales shall be such that details can be clearly shown.

Bench Marks

- (1) The Contractor shall locate and where necessary reestablish the permanent Bench Marks shown in the drawings and install additional permanent Bench Marks where directed by the Project Manager to facilitate the setting out and checking of the works. Prior to commencing the works, the Contractor shall undertake a survey, based on the same local datum as used in the original topographic survey, to confirm the elevation and horizontal position of all permanent Bench Marks and shall submit a schedule of the said coordinates to the Project Manager.
- (2) The Contractor shall be responsible for maintaining and regularly checking the elevation and position of all permanent Bench Marks for the duration of the contract. Where it is found that an existing Bench Mark is interfering with the progress of the works, the Contractor may seek the Project Manager’s approval to relocate the Bench Mark. The Contractor shall submit to the Project Manager in writing the coordinates of the new Bench Mark.

Contractor’s Ground Survey

- (1) As the bush clearing operations progress, the contractor shall set out the works in accordance with the Drawings, in a manner approved by the Project Manager. The Contractor shall undertake topographic surveys and prepare detailed site plans at an appropriate scale, of the headworks, reservoirs and other major structures identified by the Project Manager. The Contractor shall take levels along the alignment of all canals, pipelines, drains and bunds at 25m intervals or as directed by the Project Manager and shall plot the longitudinal sections to an approved scale and format.

(2) On receipt and approval of the site plans and longitudinal sections, Project Manager's engineers will finalize the design of structures and the alignment and levels of all canals, pipelines, drains and bunds. Where modifications are necessary to the original drawings, the revised drawings shall be made available to the contractor within 28 days of receipt of his approved survey drawings.

(3) The Contractor shall agree a programme with the Project Manager, for submission of the survey drawings in an ordered fashion to allow work to proceed without undue interruption whilst designs are checked and modified.

(4) The cost of setting out and carrying out the survey work shall be deemed to be included in the contractor's overall rates and no specific payment item is included in the Bill of Quantities. The period of survey and design modification shall be deemed included in the construction period, and no further extension of the construction period shall be considered due to the survey and design modification.

Temporary Works, Care of Water and Dewatering

(1) The Contractor shall construct and maintain all necessary temporary access roads, including temporary bridges if any, required in addition to the existing access roads for the construction of canals and structures within the construction sites. All temporary bridges or other temporary access facilities across the rivers shall be removed from the river channel, after having served their purpose.

(2) The Contractor shall construct and maintain all necessary cofferdams, channels, drains, sumps and/or other temporary diversion and protective works; shall furnish all materials required therefore; and shall furnish, install, maintain and operate all necessary pumping and other equipment for removal of water from the various parts of the works and maintaining the foundations and other parts of the works free from water.

(3) The Contractor shall construct and maintain all necessary channels, diversions and other temporary works necessary to ensure that irrigation water supplies are not interrupted during the

construction works.

- (4) After having served their purpose, all cofferdams or other protective works in the construction site shall be removed in a manner approved by the Project Manager, and such areas after those are removed shall be leveled and graded to the extent required to prevent obstruction in any degree whatever and maintaining the designed function of the structure.
- (5) The Contractor shall be responsible for and shall repair at his expense any damage to the foundations, structures, or any other part of the works caused by floods, water or failure of any part of the temporary diversion or protective works.
- (6) The temporary diversion channels and cofferdams at any stage shall be planned, designed and constructed in such a manner that all floods which can reasonably be expected during the construction of the work shall be safely discharged to the downstream without overtopping in any part of the embankment works or damaging the river banks in the vicinity of the construction area.
- (7) Where excavation of foundation for embankment and structures extends below the water table in common material, the portion below the water table shall be dewatered as far as possible in advance of excavation. During placing and compacting embankment material, the water level at every point on the foundation of embankment or in the cutoff trench shall be maintained below the bottom of the embankment until the compacted embankment has reached a height of 2.0 m after which the water level shall be maintained at least 1.5 m below the top of the compacted embankment.
- (8) During the placing and setting concrete in the cutoff trench or any part of the structures, the water table shall be maintained below the bottom of the newly placed concrete.
- (9) The Contractor's plan for the temporary access facility, care of water during construction, and method of dewatering from foundation excavations, embankment and concreting shall be subject to the approval of the Project Manager. Not less than thirty (30) days before intending to commence construction of any part of the temporary works at each construction site, the Contractor shall submit

to the Project Manager for his approval a detailed construction programme for permanent and temporary works and details of the following:

- (i) Plan and design of temporary diversion channels
- (ii) Plan and design of cofferdams
- (iii) Plan of temporary access roads
- (iv) Plan and design of temporary bridges
- (v) Plan of dewatering from foundation excavation for embankment
- (vi) Any other temporary works which the Contractor may consider necessary for the proper execution of the works
- (vii) Any other temporary works whatsoever the Project Manager may request

(10) The Contractor shall not commence any temporary works until the Project Manager's approval therefore has been obtained. However, such an approval shall not relieve the Contractor from any liability or obligation under the Contract. In addition, any risk consequent on the interpretation of such data shown on the Drawings is to be entirely borne by the Contractor.

The cost of furnishing all labour, materials and construction plan for construction, maintenance, removal and all other works required for temporary access and diversion, care of water and dewatering specified in this Clause shall be included in Lump Sum price, tender therefore in the Bill of Quantities.

EARTHWORKS

Site Clearance

(1) The Contractor shall prepare the site, or other areas where indicated on the drawings or ordered by the Project Manager by carrying out a general clearance of the ground and by removing trees and other vegetation to permit the proper execution of the works.

(2) Stumps and major roots shall be grubbed out and all combustible material arising shall be gathered into windrows and burnt. The contractor shall take precautions to prevent the spread of fire

to adjacent land. Material not disposed of by burning and non-combustible material shall be removed by the contractor to approved tips. The Project Manager may order certain trees to be left standing.

Surface Levels

After the area of any section of the works has been cleared and trees have been felled and stumps removed to the satisfaction of the Project Manager, 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 Project Manager. Levels shall similarly be taken on the surface of the ground after the removal of topsoil or unsuitable overburden prior to placing filling for an embankment. The levels shall be agreed with the Project Manager. The Contractor shall prepare plans and sections which shall, when finally and mutually agreed, be signed by the Project Manager and contractor as truly representing the configurations of the areas in question at the commencement of earthworks.

Definition of Earthworks

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:

- (i) "Top soil" shall mean the top layer of soil that can support vegetation;
- (ii) "Suitable material" shall comprise all that material which arises from excavations within the site and which is approved by the Project Manager as acceptable for use in the works;
- (iii) "Unsuitable material" shall mean other than suitable material and shall comprise;
 - (a) Material from swamps, marshes and bogs;
 - (b) Logs, stumps and perishable materials;
 - (c) Material susceptible to spontaneous combustion; and
 - (d) Clay of liquid limit exceeding 90 and/or plasticity index exceeding 65.
- (iv) "Soft" material shall mean all material other than that defined as rock hereunder;

(v) "Rock" shall mean those geological strata or deposits as described in the contract and any hard natural or artificial material requiring the use of blasting or approved pneumatic tools for its removal but excluding individual masses less than 0.2 cu.m.

Top Soil Stripping

Where shown on the drawings, top soil shall be removed from the sites of excavations and embankments and deposited in separate heaps for re-use as and where directed by the Project Manager.

Removal of Unsuitable Material

Where directed by the Project Manager, the contractor shall remove unsuitable material to the depths as ordered or agreed by the Project Manager and shall dispose of it in approved spoil tips

Excavation - General

(1) 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 Project Manager 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.

(2) 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 Project Manager. 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 so trimmed that no point protrudes within the required profile.

(3) The contractor shall examine all excavated faces regularly and shall remove all insecure material or materials resulting from any falls. Where instructed in writing by the Project Manager, the contractor shall wash down exposed surfaces of excavated rock for inspection.

(4) 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 Project Manager.

(5) The contractor shall be responsible for keeping all excavations free from water from whatever cause 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 excavations free from water.

(6) All excavation shall be carried out with care and the method and plant to be used in the execution thereof shall be to the satisfaction of the Project Manager. The contractor shall be responsible for the safety and security of all excavation at all times during the execution of the works and where necessary shall provide timbering, shoring or other measures required by the Project Manager 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 minimize the likelihood of slips occurring due to vibration or surcharge from the working or movement of heavy machinery.

(7) The contractor will be permitted, subject to the approval of the Project Manager, to adjust side slopes of excavations in "soft" material, which are to remain open temporarily in preference to shoring or strutting. However, no payment shall be made for the extra excavation thus incurred.

(8) The contractor shall notify the Project Manager without delay of any permeable strata, fissures or unusual ground encountered during excavation.

Blasting

(1) The contractor shall not be permitted to use explosives for rock excavation without the

approval of the Project Manager. The contractor shall only employ suitably qualified and experience personnel to manage and supervise blasting operations. For each blasting operation, the contractor shall submit to the Project Manager 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 Project Manager'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.

(2) The blasting operations shall comply in every respect with the regulations and laws covering the use of explosives in Ghana 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 Project Manager, the contractor shall make good to the required line and level with appropriate grade of filling to be contained in the true excavation, or with concrete or other approved material in such a manner as the Project Manager may direct.

Approval of Excavation

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

Excavation for Structures

(1) 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 Project Manager.

(2) 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 Project Manager. Where concrete

has to be placed on a soft foundation, the Project Manager may direct that a blinding layer of Class D concrete be placed beneath the structural concrete immediately after completion and approval of the excavation, or require the contractor to remove the last 75mm of excavation immediately prior to placing the concrete.

(3) 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 cleaned 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 Project Manager may direct that the last 300mm of rock shall be left to be removed by barring and wedging or by the use of approved pneumatic tools so that the exposed surface is sound.

(4) The Contractor shall report to the Project Manager whenever excavations are ready to receive concrete. No concreting shall be place in the foundations until the contractor has obtained the Project Manager's agreement that a secure foundation has been reached and that the excavation has been carried out to the lines and levels required.

Excavation for Fill Foundations

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

(2) Where specified on the Drawings or Specification or as directed by the Project Manager, 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 Project Manager before fill is placed thereon.

(3) Where embankments are to be constructed on sloping ground, benches shall be excavated in the foundations to the dimensions shown on the drawings, or as directed by the Project Manager.

(4) Except where specifically permitted by the Project Manager, all foundations for fill shall be kept free of water when placing fill thereon.

(5) Earth foundations shall have the top 200mm sufficiently moistened and, if necessary harrowed or scarified and compacted to at least 95 per cent of the maximum by density as determined by the standard compaction test (Number 13 in BS 1377). Material too wet to be so compacted shall, as directed by the Project Manager, be allowed to dry, harrowed or scarified to reduce the moisture content to the required amount and then be re-compacted.

Trench Excavation

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

(2) Trenches for pipes shall be excavated to a sufficient depth to enable the pipe and the specified joint, bedding, hunching and surround to be accommodated. Unless otherwise stated, the width of the trench shall be equal to the nominal diameter of the pipe plus 400mm.

(3) The Contractor shall fill any over excavation beneath the pipe or bedding with well rammed selected general excavation material. The contractor shall dispose of surplus excavated material not required for backfilling to spoil tips.

(4) The sides of trenches shall be adequately supported at all times. Alternately, where the contractor has elected and the Project Manager has approved to excavate the trenches in open cut, the contractor shall ensure that the side slopes of the excavation are sufficient for stability.

(5) 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 100mm of the outside of the pipe at any point. The over excavated portion shall be backfilled with approved granular material.

Canal and Drain Excavation

- (1) The excavation of all canals and drains shall be executed to the lines, levels and profiles shown on the drawings or as ordered by the Project Manager, and in such a manner as to ensure that the stability of the side slopes is not endangered by undercutting. Should slips or undercutting occur for reasons not attributable to the contractor's negligence or method of working, the Project Manager will give instructions to the contractor for remedial works to be carried out by the contractor at the expense of the Employer.
- (2) Where channels are to be reshaped, cleared and trimmed, the width, depth, side slopes and centre line of the final channel section shall be as shown on the drawings. The contractor shall clear all weeds and growth from existing channel and survey and agree the existing profile with the Project Manager, before commencing excavation. The section of the waterway 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.
- (3) Any canals, stream, drains or pipes which take water to or from cultivated land must be diverted so as to maintain their flow before being moved or broken into unless express permission to the contrary is obtained from the Project Manager. All diversions and their subsequent reinstatement are to be carried out to the satisfaction of the Project Manager.
- (4) Side slopes of channels shall be trimmed to a neat appearance and even surface.
- (5) In the construction of channels and embankments a local balance of cut and fill shall be maintained as far as possible. A deficiency of fill material shall be made up from bed borrow or gleaning. Surplus material, if suitable and approved by the Project Manager may be used for an increased width of embankment otherwise it may be spread at the toe of the embankment or placed in spoil tips as directed by the Project Manager.

Disposal or Excavated Material

- (1) Material obtained from excavations, which is 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 hauled to spoil tips provided by the contractor, unless otherwise provided or permitted by the Project Manager.
- (2) 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 fill arising therefrom, unless otherwise agreed by the Project Manager.
- (3) All material not suitable for embankments or other filling shall, unless otherwise directed by the Project Manager, be hauled to separate spoil tips provided by the Contractor.

Spoil Tips

- (1) The Contractor shall be responsible for the provision and sufficiency of tips for the permanent disposal or spoil and shall select their location within the general areas indicated on the drawings or as otherwise designated or approved by the Project Manager. The contractor shall submit his proposals for the locations and detailed treatment of tips to the Project Manager 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.
- (2) No spoil shall be permanently deposited other than in approved spoil tips. Spoil tips shall be built up and compacted and trimmed and regulated to levels and profiles approved by the Project Manager. Where directed by the Project Manager, upper surfaces and slopes of the tips shall be top soiled to specified thickness.

Borrow Pits and Quarries

- (1) Where there may be an insufficiency of suitable material from excavations for filling, the

contractor shall obtain such material from borrow pits or quarries approved by the Project Manager where the filling is required for the permanent works.

(2) The contractor shall investigate the site which he proposes to open up and shall provide full and detailed information by means of boreholes, trial pit testing reports, etc, to satisfy the Project Manager that the quality of the material meets the requirements of the specification and that the quantity is adequate for the works.

(3) Notwithstanding the foregoing, the Project Manager shall have the right to order the contractor to obtain materials from a particular designated source or by widening cuttings in the permanent works beyond the lines show on the drawings.

(4) 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 double-handling of suitable materials, 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.

(5) The pits and quarries shall be operated in a safe manner and be provided with ample drainage to leave 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 Project Manager.

Earth Filling

(1) Material for filling shall be obtained from approved sources or selected from excavations containing no vegetation or perishable matter, graded to ensure a dense stable and homogeneous fill when compacted and to the approval of the Project Manager.

(2) Prior to commencement of filling, the contractor shall submit in writing to the Project Manager for approval his proposals for carrying out the work such that the optimum use may be made of

excavated material and 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 Project Manager.

(3) Embankments shall be built to the lines, levels and profiles shown on the drawings or as ordered by the Project Manager. The levels shown are those required after settlement by natural consolidation or compaction. All material for filling shall be free from tree roots and other vegetative matter, building rubbish, and stones and lumps retained on a 75mm sieve or other deleterious material.

(4) Fill shall be placed in layers not exceeding 150mm thickness, each layer being scarified and thoroughly compacted to obtain a dry density not less than 95% of the Proctor maximum dry density as determined by Test Number 12 of BS 1377, "Methods of test for soils for civil engineering purposes". The in-situ dry density of the compacted fill shall be determined by taking cores with a hand augur. The fill material, prior to compaction shall be brought to a moisture content within the range $\pm 2\%$ of the optimum as determined by Test Number 12 of BS 1377. If watering is required, it shall be carried out in such a manner as to ensure the even distribution of water throughout the layer to be compacted and the compaction operations will follow whilst the moisture content remains within the specified range.

(4) 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 Project Manager.

(5) Any instability of any adjacent excavation resulting from the embankment not being formed to the lines, levels and profiles shown in the drawings or as ordered by the Project Manager will be the responsibility of the contractor. Where double-handling of excavated material is necessary, the contractor will be responsible for the temporary deposition of the material such that it does not endanger the stability of the excavation.

Backfilling of Structural Excavations

(1) Backfilling of structural excavations shall be carried out with spoil selected and approved by the Project Manager. The spoil shall be placed in layers not exceeding 200mm compacted thickness or other such thickness as the Project Manager may approve or direct and shall be compacted as specified in Clause 317.

(2) 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 Project Manager so that no unequal pressures likely to cause damage to the structure are applied.

Filling under Raised Foundations

(1) The material to be used as general 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 100mm loose thickness. The material shall be compacted to the degree of compaction specified in Clause 317.

(2) Hardcore under floor slabs shall consist of hard stone, broken concrete blocks or bricks or other sound hard material approved by the Project Manager. It shall not exceed 100mm in any dimension and shall be free from dust, clay, rubbish, wood or any other deleterious matter. Hardcore shall be compacted by hand tamping with a heavy tamper or by use of suitable mechanical equipment and shall be well watered during compaction. The hardcore shall be blinded with sand swept into the interstices of the finally compacted hardcore and highly ramped or rolled.

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 1 vertical in 2 horizontal and a "batter of 4 to 1" will mean 4 vertical to 1 horizontal. This meaning will be attributed to all other terms such as "inclination" and "gradient".

Cross Ripping

Prior to the installation of tertiary canals or pipelines, the irrigable area shall be cross ripped to a depth

of 500mm in two perpendicular directions. The ripper tines shall be set at a maximum spacing of 1m and shall be designed to lift roots and large stones to the surface where they shall be collected and burnt or removed to tips, approved by the Project Manager, located outside the irrigable area.

Land Smoothing and Leveling

Land smoothing and leveling shall first involve the rough leveling of isolated hillocks and holes, followed by the smoothing of the individual irrigable plots and cutting of field drains using a bulldozer or a grader.

(1) High spots, such as anthills shall be flattered and the material spread over the surrounding area to leave an even surface. Existing holes and depressions shall be filled either with material trimmed from the surrounding area or borrow pits as directed by the Project Manager.

(2) Prior to commencing the smoothing operation the alignment of tertiary canals, pipelines and drains shall be pegged on the ground. Commencing at the top of each irrigable block, the contractor shall survey a smooth line on a 1:500 ~ 1:1000 gradient away from the tertiary canal or pipeline towards the tertiary drain within a plot where developed for upland and shall survey a level line within a plot where developed for paddy. The tertiary canal along the line and to the profile shown in the Drawings shall then be excavated.

(3) Operating in a series of passes, the grader or the bulldozer shall smooth the land at smooth slopes or level within the boundaries of the plots as shown in the Drawings or otherwise directed by the Project Manager. The process is then repeated to the lower plots by pegging and smoothing or leveling.

(4) The land smoothing and leveling shall be done within the tolerance given in the Appendices, and the final smoothing and leveling will be done by the farmers.

Chisel Ploughing

After the smoothing operation the individual plots shall be chisel ploughed to a depth of 300mm, using

a seven tine chisel plough approved by the Project Manager.

Top soiling

The Contractor shall obtain topsoil from temporary dumps or approved borrow-pits and shall spread it on level or sloping surfaces, where ordered, to specified depth.

Grassing

- (1) The topsoil shall be lightly and uniformly raked to give a fine tilt up to 25mm deep.
- (2) The surface shall be grassed with a local grass with a creeping habit, of which the source and variety shall be approved by the Project Manager. Grass sprigs shall be planted at 0.3m x 0.3m spacings. The grass shall be adequately watered until such time as the grass becomes established.
- (3) Should the growth fail to become established for any reason the contractor shall recultivate and replant grass as necessary at his own cost in accordance with the above specification, for as many times as necessary for the grass to become established. Having grown to between 50 and 75mm high, the grass shall be topped by cutting to leave between 25 and 50mm minimum growth and watering shall be continued as necessary until the grass is firmly established to the Project Manager's satisfaction.

Trial Pits

Where directed to excavate trial pits, the contractor shall keep these open for as long as the Project Manager may direct. During the whole of this period the contractor shall adequately fence or cover over the pits as directed and pump them out as and when required.

Auger Holes

Where directed, the contractor shall sink auger holes through soft material in such a way as to give continual visual evidence of the nature of the ground and the taking of 50mm diameter undisturbed tube samples at every change in stratum or at every 1.5m where strata exceed that thickness. Wash-auguring methods will not be permitted.

Records of Auger Holes

Auger holes shall be sunk by competent operatives and under skilled supervision. Exact records shall be kept for each auger hole showing the nature extent and depth of the materials passed through, the level or levels at which water was met and the level of standing water in the completed hole. These records shall be in a form approved by the Project Manager and shall include a diagram of the hole. Records shall be provided to the Project Manager daily.

Samples

(1) Undisturbed samples shall be retained in the tubes in which they are taken, immediately after being taken from the auger hole the ends of the sample shall be removed to a depth of 6mm and several layers of molten paraffin wax applied by brush. Any space between the end of the tube and the top of the wax shall be tightly packed with suitable material and an airtight lid or screw cap placed on each end of the tube.

(2) Disturbed samples, immediately after taken shall be placed in airtight glass jars.

(3) Each sample should be clearly marked with the auger hole reference and level from which it was taken, and numbered in accordance with the Project Manager's Instructions and shall then be transported to the Testing Laboratory.

Preparation of Formation in Lined Canals

The Contractor shall sterilize the formation in canals which are to be subsequently lined in concrete to prevent vegetation growth. Sterilization shall be by spraying a water solution of polyborchlorate (270g of powdered polyborchlorate per sq.m) immediately following the final trimming and shaping to the required profile.

Earthworks Tolerances

Earthworks shall be executed to the tolerances stated in the Appendices or to such other tolerances as the Project Manager may approve.

CONCRETE

Concrete

Concrete shall consist of cement, graded aggregate and water thoroughly mixed, placed and compacted as specified in the following clauses.

Chlorides in Concrete

The total combined content of calcium chloride and sodium chloride in any batch of concrete is not to exceed 0.334 by weight of the amount of cement.

Cement

(1) The cement used throughout the Works shall be obtained from manufacturers approved in writing by the Project Manager and shall as appropriate comply with the following specification:

BS 12 **“Portland cement”**

BS 1370 **“Low heat Portland cement”**

(2) Except where otherwise specified the cement shall be Ordinary Portland Cement (OPC).

Cement Testing

(1) All cement shall be certified by the manufacturers as complying with the requirements of the appropriate 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 Project Manager may satisfy himself that the quantity and quality required can be supplied and maintained throughout the construction period. Where necessary the Project Manager may require further representative samples of the proposed cement to be taken and forwarded to a nominated laboratory for analysis and testing before the source is approved.

(2) Having obtained the Project Manager's approval of the source(s) of supply, transport, storage and certification of the cement, the Contractor shall not modify or change the agreed arrangements

without first having obtained the Project Manager's permission.

(3) In addition to routine test certificates, which are to be supplied by the manufacturer to show the average results of sample tests made on batches of cement produced at the works, the Project Manager may also make any further tests which he shall consider necessary or advisable to satisfy himself that the cement on site complies with the Specification and has not suffered deterioration in any manner during transit or storage.

(4) The Contractor shall ensure that the arrangements for the storage of the cement on the site as hereinafter specified are sufficient for the segregation and identification of each consignment until the results of the sampling and testing referred to in Subclause (3) above are available.

(5) No cement shall be used in the works until it has been passed as satisfactory by the Project Manager.

Storage of Cement

(1) Cement shall be delivered to the site of the works in sound and properly sealed bags and while being loaded or unloaded and during transit to the concrete mixers whether conveyed in vehicles or by mechanical means, must be protected from the weather by effective coverings.

(2) The Contractor shall provide at his own cost perfectly weatherproof and well-ventilated sheds having a floor of wood or concrete raised at least 300mm above the ground for the storage of the cement. The sheds shall be large enough to store Sufficient cement to ensure continuity of work and each consignment must be stacked separately therein to permit easy access for inspection, testing and approval. On delivery at the site, the cement is at once to be placed in these sheds and shall be used in the order in which it has been delivered. Cement which has been damaged in transit to the site or has become stale or otherwise unsuitable, and hardened lumps or cakes of cement which cannot be crumbled into fine powder in the hand shall not be used in the permanent works except with the specific approval of the Project Manager.

Fine Aggregate

- (1) Fine aggregate for concrete shall be clean sand complying with BS 882, "Aggregates from natural sources for concrete". The sand shall be from approved sources and which in the opinion of the Project Manager is not clean shall be washed before use.
- (2) Crushed sand up to a maximum of 50% may be added to natural sand in order to achieve the required grading. Crushed sand alone may only be used with approval of the Project Manager.
- (3) Sand for use in mortar and rendering shall conform in all respects with BS 1199 and 1200, "Building sands from natural sources".

Coarse Aggregate

- (1) Coarse aggregate for concrete and other purposes shall comply with BS 882, "Aggregates from natural sources for concrete". It may be either natural gravel or stone broken to the desired size and shall be obtained from quarries, pits or other sources approved by the Project Manager.
- (2) Gravel or ballast shall be free from clay, earth, loam or other organic or similar material and shall be approved by the Project Manager. Any sand that may be amongst it shall, unless otherwise directed, be removed by screening if required and kept apart. Should the sand thus obtained be suitable in the opinion of the Project Manager for use in concrete, it may be used for the purpose provided that it complies with the conditions specified for sand in the preceding Clause. Gravel or ballast which in the opinion of the Project Manager is not clean shall be thoroughly washed before use.
- (3) Broken stone shall be of hard durable rock. Notwithstanding approval by the Project Manager of its source, the stone as delivered to the works will be subject to rejection if for any reason the Project Manager considers it unsatisfactory. It must be perfectly clean and no soft, clayey, shaly or decomposed stone will be approved. The stone must be broken in a stone crusher of approved type to the sizes hereinafter specified and any dust or fine material below 5mm in size made in the stone crusher is to be removed by screening if so required and if the Project Manager so orders the stone shall be thoroughly washed by an approved method.

(4) When so required and before the work is commenced, laboratory tests shall be made of the aggregates to be used on the works to establish their suitability for concrete. In addition to these laboratory tests the Project Manager may require check tests of Actual deliveries to be made at the site from time to time.

(5) The grading of coarse aggregate by analysis shall be within the limits laid down in BS 882, Table 1, Coarse Aggregates. Should an analysis of the grain size of the material show a deficiency in any particular size such as to affect the density of the concrete, the Project Manager may require the Contractor to add such quantity of aggregate of any particular size that he may deem advisable. In every case the material shall when mixed with sand produce a well graded mixture from the largest to the smallest size specified to ensure that concrete of high density shall be produced.

Storage of Aggregates

All sand and aggregate for concrete shall be stored on close fitting timber, steel or concrete stages of approved design with drainage slopes or in bins of substantial construction in such a manner as to prevent segregation of sizes and to avoid the inclusion of dirt and other foreign materials in the concrete. All such bins shall be emptied and cleaned at intervals as instructed by the Project Manager. Each size of aggregate shall be stored separately unless otherwise approved by the Project Manager.

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 Project Manager. If required by the Project Manager, samples shall be taken from the proposed source of supply and submitted to a nominated laboratory for testing in accordance with BS 3148, "Tests for water for making concrete" and on the results of these tests the Project Manager will decide whether the source is acceptable.

Additives and Admixtures

(1) The use of non-corrosive additives or admixtures in concrete may be ordered or approved by the Project Manager according to circumstances. Such approval will only be given when the contractor has demonstrated to the satisfaction of the Project Manager that the resulting concrete is no less strong,

dense and durable than that obtainable without the use of additives.

(2) Samples and the manufacturer's full data and instructions of any additive or admixture proposed by the contractor shall be submitted for testing at least 60 days in advance of use, which shall required the written approval of the Project Manager.

(3) When additives or admixtures are used in the works very strict control is to be maintained to ensure that the correct quantity is used at all times.

Steel for Concrete

(1) Steel reinforcement used in reinforced concrete shall comply with the following British Standards as appropriate:

BS 4449	"Carbon steel bars for the reinforcement of concrete"
BS 4461	"Cold worked steel bars for the reinforcement of concrete"
BS 4482	"Cold reduced steel wire for the reinforcement of concrete"
BS 4483	"Steel fabric for the reinforcement of concrete"

(2) The Contractor shall furnish the Project Manager with copies of the manufacturer's certificates of tests for the steel reinforcement to be supplied. The Project Manager 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.

(3) Bends, cranks or other labours on reinforcement bars shall be carefully formed in accordance with the drawings, BS 4466, "Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete" and BS Code of Practice 114, Part 2 "Structural use of reinforced concrete in buildings". The bars shall be bent cold in a manner which will not injure the material. Bends shall be made round a former having a diameter of at least four times the diameter of the bar except for bends in cold twisted steel bars for which a former of at least six times the diameter of the bar shall be used. Where splices or overlapping in reinforcement is required the bars shall, unless otherwise shown on the

drawings, have an overlap of not less than thirty diameters where a U-hook is employed on each of the overlapping bars and forty-five diameters on bars without hooks. Fabric reinforcement sheets are to overlap by two meshes.

(4) The number, size, form and position of all steel reinforcing bars, ties, links, stirrups and other parts of the reinforcement shall be in exact accordance with the drawings and they shall be kept in the correct position and with the required cover without displacement during the process of compacting the concrete in place in a manner approved by the Project Manager. The contractor shall provide all necessary distance pieces and spacer bars at his own cost to maintain the reinforcement in the correct position. The type of distance piece shall be subject to the approval of the Project Manager. Timber blocks for wedging the steel off the formwork will not be allowed. Any ties, links or stirrups connecting the bars shall be taut so that the bars are properly braced and the inside of hooks and bends shall be in actual contact with the bars around which they are intended to fit. Bars shall be bound together with best black annealed mild steel wire and the binding shall be twisted tight with pliers. The free ends of binding wire shall be bent inwards.

(5) Before any steel reinforcement is embedded in concrete any loose mill scale and 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.

Concrete Strength

(1) The strength of concrete to be used in the works shall be as shown on the drawings, Bills of Quantities or as directed by the Project Manager. The characteristic 28 day curing strengths, when tested in accordance with the following clauses:

(2) The term characteristic strength means the value of the strength of concrete below which not more than 5 percent of the test results fall.

(3) Before any concrete is placed in the works, the contractor shall submit to the Project Manager for his approval full details of the mixes he proposes to use for each Class of concrete together with

their expected average strengths. These mixes shall be based on the results of trial mixes as specified hereafter.

Concrete Mix Designs

Preliminary tests are to be carried out jointly by the contractor and the Project Manager to determine the mixes which will satisfy the specification with the available materials. These mixes shall be designed with due regard for the workability necessary to allow the contractor to place and compact the concrete with the equipment he proposes to use in any particular situation.

Trial Mixes

Unless there are existing data showing that the proposed mix proportions will produce the grade of concrete required with adequate workability for full compaction by the method to be used in production, trial mixes shall be prepared under full scale conditions and tested in accordance with BS 1881, "Methods of testing concrete". Trial mixes shall also be made subsequently whenever a change is intended in materials or in the proportions of the materials to be used. Representative samples of the materials to be used shall be taken and three trial mixes using the proposed proportions shall be made on different days. The workability of each of these three mixes shall be determined and a batch of six cubes from each mix shall be made three for tests at 7 days and three for tests at 28 days. The Project Manager will normally approve the proposed mix proportions provided the average strength of the three trial mixes is not less than the designed mean strength minus the designed standard deviation and subject to the conditions noted below. Further trial mixes shall be made if the range of strengths, that is the maximum minus the minimum, of the three cube results in any batch exceeds 15% of the average of that batch, or if the range of the three batch averages exceeds 20% of the overall average of the batches.

Works Test

Test cubes shall be made, cured, stored, transported and tested in compression in accordance with BS 1881, "Methods of testing concrete". The method of compacting cubes by vibration shall be subject to the approval of the Project Manager.

Samples of concrete shall be taken at random each day for each grade of concrete made. The number

of samples per day and the times which they shall be taken shall be varied at random or as directed by the Project Manager.

In addition, slump tests shall be carried on each batch from which cubes are taken.

From each sample two cubes shall be made for testing at 28 days and one for testing at 7 days for control purposes.

Additional Cube Tests

In addition to the works test cubes described above, the Project Manager may order additional cubes to be made for the following purposes; to determine the strength of concrete at the time of stripping moulds, to determine the duration of curing or to check testing errors.

Test Failure

- (1) Should any works test cube fail to attain the specified strength, an immediate examination shall be made to find the cause of the failure and a report sent to the Project Manager who will take suitable action which may be one of the following:
 - (I) He may order the concrete corresponding to the cubes to be cut out and replaced in accordance with Clause 35 of the Conditions of Contract.
 - (ii) When the failure relates to concrete used in structural members which lend themselves to being load tested such as beams, columns or slabs, the Project Manager may order the affected member to be so tested in accordance with his instructions. If cracking or any other sign of failure appears, the concrete shall be cut out to the extent ordered by the Project Manager and replaced with sound material. Otherwise, the member may be accepted as satisfactory.
 - (iii) When the failure, in the opinion of the Project Manager, is slight and occurs in a continuing concreting operation for a large mass of concrete, the next works test result may be awaited and, if the failure then persists, the Project Manager may order that concreting shall cease forthwith and not be

resumed until further preliminary tests indicate that the mix has been corrected. Otherwise, the concreting may be allowed to continue with the same mix.

(2) The cost of these tests including the cutting out and replacing of concrete of inferior quality shall be borne by the contractor if the test results show the concrete not to be in accordance with the specification.

Workability

(1) The concrete shall be of such consistency that it can be readily transported, placed and compacted in the works without segregation of the materials. The resulting concrete shall be uniform and free from honeycombing.

(2) Prior to the approval of the trial mixes, the Project Manager may require the Contractor to erect a section of formwork complete with reinforcement fixed in position and generally representative of the sections comprising the works. This formwork shall be filled with concrete produced for the trial mixes and compacted in the same manner and with the same equipment to be used in the works. The appearance of the concrete after striking the formwork shall be to the satisfaction of the Project Manager who may otherwise require the mix to be modified and further batches of concrete made and tested as above.

(3) The water/cement ratio for the various classes of concrete shall be determined by the trial mixes and in no case shall the water/cement ratios used be allowed to exceed by more than 10 percent those determined by the trial mixes. Efficient means shall be provided for determining the moisture content of the sand and coarse aggregate at all times. The contractor shall be required to have an accurate knowledge of the moisture content of all sand and coarse aggregate as they reach the mixer and he shall make such adjustments to the mix as are necessitated by change in the moisture content of all aggregate.

Consistency

The contractor shall carry out slump, compaction factor or other workability tests as required during concreting of permanent works in order to relate the degree of workability of the mix with the

numerical value obtained during the trial mixes.

Concrete Return Records

The contractor shall send weekly to the Project Manager a return showing the quantities of cement and the number of mixes 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 Project Manager.

Batching

The aggregates and cement shall be proportioned by means of efficient weigh batching machines except when the Project Manager 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 Project Manager.

For volume batching suitable gauge boxes shall be used. Cement shall be taken as weighing 1440 kg/cu.m or other such amount as may be determined by the Project Manager as a result of tests.

Mixing Concrete by Machine

The concrete is to be mixed in machines of the batch mixing or other approved type. The machines are to ensure that all the concreting materials including the water are thoroughly mixed together between the time of their deposition in the mixer and before any portion of the mixture is discharged. 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 Project Manager, 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.

Transport of Concrete

The concrete shall be discharged from the mixers and transported to the works by means which shall be approved by the Project Manager and which shall prevent contamination, (by dust, rain or other causes) segregation or loss of ingredients. The means of transportation shall ensure that the concrete is of the required workability at the point and time of placing.

Placing of Concrete

- (1) The concrete shall be placed in the positions and sequences indicated on the drawings, in the Specification or as directed by the Project Manager. Except where otherwise directed, concrete shall not be placed unless the Project Manager or his representative is present and has previously examined and approved the positioning, fixing and condition of reinforcement and any other items to be embedded and the cleanliness, alignment and suitability of the containing surfaces or formwork.
- (2) The concrete shall be deposited as nearly as possible in its final position without rehandling or segregation and in such a manner as to avoid displacement of the reinforcement, other embedded items or formwork. Wherever possible bottom opening skips shall be used. Where chutes are used to convey the concrete, their slopes shall not be such as to cause segregation and suitable spouts or baffles shall be provided where necessary. Concrete shall not be dropped through a height greater than 1m except with the approval of the Project Manager who may order the use of bankers and the turning over of the deposited concrete by hand before being impact.
- (3) Where pneumatic placers are used the velocity of discharge shall be regulated by suitable baffles or hoppers where necessary to prevent segregation or damage and distortion of the reinforcement, embedded items and formwork, caused by impact.

(4) All concreting shall be carried out in sections previously ordered or approved by the Project Manager and shall proceed continuously in each section until completed and no interval shall be allowed to elapse while the work is in hand.

(5) The concreting shall be carried out in such a way that the exposed faces of concrete shall be sound and solid, free from honeycombing and excrescences. No plastering of imperfect concrete faces will be allowed, any concrete that is defective in any way will, if so ordered by the Project Manager, be cut out and replaced to such depth or be made good in such manner as the Project Manager may direct.

(6) Where concrete is required to be placed against undisturbed ground, the entire space between the finished concrete surface and the ground, including any overbreak, is to be completely filled with concrete of the specified class. The concrete shall be well rammed and compacted to ensure that all cavities are filled and the concrete is everywhere in contact with the ground. Where permitted by the Project Manager, any extensive patches of overbreak may first be filled with Class D concrete as directed to within 100mm of the payment line.

(7) Where concrete is required to be placed against a metal surface to which it is required to adhere, care shall be taken to work the concrete well into the re-entrant angles and to ensure contact by hammering the metal part on its free side providing that this can be done without damaging the metal or its protective coating, if any, or by other means.

(8) The placing of concrete under water will be permitted only in exceptional circumstances and with the prior approval of the Project Manager. Where concreting under water is allowed, 25 percent additional cement must be added. Concrete shall be deposited continuously in each section by the use of tremie pipes or other approved means and no horizontal construction joints will be permitted to be made under water and approved and adequate protection against possible damage or movement due to scour must be provided.

No Partially Set Material to be Used

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

Compaction of Concrete

The concrete shall be fully compacted throughout the full extent of the layer and shall be brought up in level layers of such depth that each layer is readily and properly incorporated with the layer below with the use of internal vibrators or by spading, slicing or ramming. It shall be thoroughly worked against formwork and around any reinforcement or embedded items without displacing them.

Vibration of Concrete

(1) Except where otherwise permitted by the Project Manager, concrete shall during placing, be compacted by hand held vibrators of a type to be approved by the Project Manager. The vibrators shall be suitable for continuous operation. The vibrators shall be disposed in such a manner that the whole of the mass under treatment shall be adequately compacted at a speed commensurate with the supply of concrete from the mixers. Vibration is to continue until the concrete being placed is fully compacted and all air bubbles have been expelled. Care must be taken that segregation of mortar and aggregate by excessive vibration is avoided.

(2) Vibration is not to be applied directly, or through the reinforcement, to sections or masses of concrete which have hardened or after the initial set has taken place. Vibration must not be used to make the concrete flow in the formwork so as to cause segregation.

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

Concreting at Night or in the Dark

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 is in progress.

Concreting in High Ambient Temperature

(1) Where the ambient shade temperature exceeds 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 30°C. The Contractor shall carry out all necessary special measures to ensure that the maximum concrete temperature within 7 days after placing shall not exceed 50°C or 30°C above the concrete temperature at the time of placing whichever is the lower.

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

Protection

(1) Concrete shall be protected during the first stages 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 his proposals to achieve this protection for the Project Manager's approval. Protection of concrete which has achieved its final set shall consist of one or more of the following:

(i) 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 7 days or such periods as may be directed by the Project Manager.

(ii) After thoroughly wetting, a layer of approved waterproof paper or plastic membrane kept in contact with the concrete for 7 days or such period as may be directed by the Project Manager.

(iii) Except in the cases of surfaces to which concrete has subsequently to be bonded, an approved liquid curing membrane at a rate specified by the manufacturer. On non-formed surfaces the curing membrane shall be applied immediately after placing the concrete and on formed surfaces immediately after removing the formwork.

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

Construction Joints

(1) 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 Project Manager. 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. Keyways are to be formed in all horizontal and vertical construction joints, except where ordered to be omitted by the Project Manager.

(2) Where vertical construction joints are required, the joint face of the first cast 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 roughened or scabbled with suitable tools so that no smooth skin of concrete is visible and that all aggregates and the solid matrix around them are exposed.

(3) 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.

(4) If, in the opinion of the Project Manager, 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 Project Manager shall order and the roughened

surfaces shall be thoroughly cleaned by compressed air and water jets or other approved means.

- (5) Immediately before concreting is resumed, the roughened joint surface shall be thoroughly cleaned with compressed air and water jets and slightly wetted. The contractor shall take precautions to avoid segregation of the concrete along the joint place and to obtain thorough compaction.

Movement Joints

- (1) Movement joints shall be formed in the position and manner shown on the Contract Drawings. In the case of water retaining structures, joints shall be made watertight by the provision of a continuous waterstop, with suitable water resistant filler material and sealant.

(2) Materials and Workmanship

- (I) 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 140% when immersed in boiling water for 1 hour. 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.
- (ii) Waterstop, either centrally or externally placed, shall be Polyvinyl Chloride (PVC) of the dimensions and type shown on the Drawings. 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 surrounding steelwork. Externally placed water stops shall include a wide reinforced nailing flange for positive fixing to formwork or adjacent concrete faces. Water-stop 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 waterstops from damage during the progress of the work and from sunlight

and heat. Where waterstops are required to be jointed, this shall be undertaken using approved heat welding equipment. The waterstops shall be installed in accordance with the manufacturer's instructions and to the approval of the Project Manager.

(iii) Joint sealant shall be cold gun applied compound combining bitumen with synthetic rubber which sets after application to form a rubbery seal, which is both flexible and weather resistant. The sealant shall be unaffected by permanent immersion in water be resistant to alkalis and sulphates and shall be capable of accommodating a 20% change in joint width. The type of sealant shall be approved by the Project Manager before incorporation into works. Before joint sealants are applied, the concrete shall be fully cured and all joints shall be thoroughly dry and clean to the satisfaction of the Project Manager. The surface of the joint shall be mechanically cleaned to form a sound, latence free surface and shall be primed in accordance with the manufacturer's instructions.

(iv) 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, waterstops and sealant specified previously.

(3) 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, waterstops 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. The casting of waterstops 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.

(4) 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, waterstops, 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 Project Manager. The casting in of waterstops 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.

Preparation of Surfaces to Receive Concrete

(1) Before concrete for reinforced concrete work is deposited on a foundation of soft ground, a screed of blinding concrete Class D of 75mm minimum thickness, shall be placed over the ground before the underside level of the reinforced concrete to form a hard even surface on which to construct the latter.

(2) Immediately before depositing concrete on or against a surface of masonry, brickwork, old concrete or the like, the following preparation shall be done. All loose material shall be removed and the surface washed down; all seepages of water emerging at the surfaces shall be stopped as far as possible or suitably channelled or piped away from the work. On upward facing horizontal or near horizontal surfaces a layer of 2:1 sand-cement mortar is to be spread over the surface of the section to be concreted if so directed by the Project Manager.

Concrete Formwork

(1) The contractor shall submit for the approval of the Project Manager details of the methods and materials proposed for formwork to each section of the work. Details of all proposed fair faced formwork and formwork to produce special finishes are to be submitted for approval in writing, by the Project Manager before any materials are brought on to the Site. If the Project Manager so requires, samples of formwork shall be constructed and concrete placed so that the proposed methods and finish effect can be demonstrated.

(2) Formwork shall be constructed from sound materials of sufficient strength, properly braced struted and shored in order to ensure rigidity throughout the placing and compaction of the concrete without visible deflection. Formwork shall be so constructed that it can be removed without shock or

vibration to the concrete. No part of any metal tie or spacer remaining permanently embedded in the concrete shall be nearer than 50mm to the finished surface and the cavity shall be so formed as to permit satisfactory filling with cement mortar.

(3) All joints shall be close fitting to prevent leakage of grout and at construction joints the formwork shall be tightly secured against previously cast or hardened concrete to prevent stepping or ridges to exposed surfaces.

(4) Formwork shall be constructed to provide the correct shape, lines and dimensions of the concrete shown on the Drawings. Due allowance shall be made for any deflection which will occur during the placing of concrete within the formworks. Panels shall have true edges to permit accurate alignment and provide a neat line with adjacent panels and at all construction joints. All panels shall be fixed with their joints either vertical or horizontal, unless otherwise specified or approved. Unless otherwise detailed, arises of all concrete shall be finished to a 25mm x 25mm chamfer. When chamfers are to be formed, the fillets shall be accurately cut to size to provide a smooth and continuous chamfer.

(5) The contractor may be permitted to use precast concrete blocks or masonry left permanently embedded in the structure as a substitute for temporary formworks. Where such permission is given, the blocks shall have positive anchorage with the structure and all joints shall be made properly tight with mortar or other means to prevent leakage of grout and shall provide an exposed face of the necessary quality. The blocks of concrete or masonry shall stand outside the limits of concrete shown on the drawings unless otherwise agreed by the Project Manager. If the contractor chooses to use this method, payment will be made as if formwork had been used.

Formwork for Exposed Concrete Surfaces

Unless otherwise stated on the drawings, fair faced formwork shall be used for all permanently visible concrete surfaces. Fair faced formwork shall be such as to produce a smooth and even surface free from perceptible irregularities. Tongued and grooved placed boards, plywood or steel forms shall have their joints flush with the surface. The finished surface shall be within the tolerances specified and full cover to reinforcement steel shall be maintained.

Formwork for Non-Exposed Concrete Surfaces

Unless otherwise stated on the drawings, rough formwork may be used for all surfaces which are not permanently exposed. Rough formwork may be constructed of plain butt-joined sawn timber but the contractor shall ensure that all joints between boards shall be grout-tight. The finished surface shall be within the tolerances specified and full cover to reinforcement steel shall be maintained.

Preparation of Formwork for Concreting

- (1) Before concrete is placed, the formwork shall be thoroughly cleared and free from sawdust, shavings, dust or other debris. Temporary openings shall be provided to assist in the removal of rubbish.
- (2) After cleaning, the formwork shall be coated with an approved release agent, which shall not be allowed to run on to reinforcement, other embedded steelwork or concrete at any construction joint.
- (3) All formwork shall be inspected and approved by the Project Manager before concrete is placed in it, however this shall not relieve the contractor from the requirements as to soundness, finish and tolerances of the concrete specified elsewhere.

Removal of Formwork

Formwork shall be removed in such a manner as will not damage the concrete. No formwork shall be removed until the concrete has gained sufficient strength to support itself. Centres and props may be removed when the member being supported has gained sufficient strength to carry itself and the load to be supported on it with a reasonable factor of safety. The following table is a guide to the minimum periods which must elapse between the completion of the concreting operations and the removal of formwork. No formwork shall be removed without the permission of the Project Manager and such permission shall not relieve the contractor of his responsibilities for the safety of the structure.

Minimum stripping and striking times shall be as follows unless otherwise approved by the Project Manager:

Hours

Vertical surfaces	10
Vertical wall surfaces under 300mm thick	30
Beam sides and columns	30

Days

Slabs with props left under	4
Removal of props to slabs	9
Beam soffits with props left under	7
Removal of props to beams	17

Cover to Reinforcement

The concrete cover to reinforcement shall be a minimum of 50mm or as shown on the drawings. The contractor shall provide all necessary cement pads for ensuring the cover is attained and in no case shall timber packing be used.

Concrete Surface Finish

- (1) The concrete surface finish on upward facing or sloping faces shall, except for blinding concrete, or otherwise stated on the drawings, be a "fair" surface. A "fair" surface shall be obtained by screeding and trowelling with a wooden float.
- (2) Screeding shall be carried out, following compaction of the concrete, by the slicing and tamping action of a screed board running on the top edges of screeding guides to give a dense concrete skin true to line and level.
- (3) Wood float trowelling shall be carried out after the concrete has, stiffened and the moisture film has disappeared. Working should be kept to a minimum compatible with a good finish and the surface shall be true to the required profile to fine tolerance. Whenever necessary the contractor shall provide and erect overhead covers to prevent the finished surface from being marred by raindrops or dripping water.

- (4) The surface of blinding concrete shall be that obtained by screeding as described above.
- (5) Where a "fine" surface is indicated on the drawings, this shall be obtained in a similar manner to a "fair" surface save that a steel float shall be used instead of the wooden float.

Precast Concrete

- (1) Concrete members specified to be fabricated as precast concrete units shall be fabricated with concrete of the specified class placed into a grout-tight mould. If so required the mould shall be laid on a vibrating table and vibration applied while the concrete is placed.
- (2) Permanently exposed surfaces shall have a finish obtained by casting the unit in properly designed moulds of closely-jointed wrought boards or steel or other suitable material. The surface shall be improved by carefully removing all fins and other projections, thoroughly washing down and filling the most noticeable surface blemishes with a cement and fine aggregate paste matching the colour of the concrete.
- (3) Surfaces which will subsequently receive grout or concrete to complete a structural connection or other composite structural component of which the precast unit forms a part, shall be prepared as early possible after casting. This preparation shall be carried out preferably when the concrete has set but not hardened by jetting with a fine spray of water or brushing with a stiff brush, just sufficient to remove the outer mortar skin and to expose the larger aggregate without its being disturbed. Where this treatment is impracticable, sand blasting or a needle gun should be used to remove the surface skin and latence. Hacking is to be avoided.
- (4) With the approval of the Project Manager the contractor may be permitted to precast members which were specified to be constructed in-situ, in such cases the contractor shall carry out the work as described above but payment shall be made in the manner appropriate to the method of construction originally specified. Generally members which are structurally dependent on a rigid fixing with the adjoining structures will not be permitted to be constructed by precasting.

(5) Precast units shall be jointed with cement mortar as specified in Clause 448 hereof or other cement-sand proportions as shown on the drawings, or as may be directed by the Project Manager, but mixed as dry as possible so that it is only "earth moist". The mortar shall be packed in layers between the units with steel tools until the whole of the joint is solidly filled and the exposed surfaces of the joint shall be raked out to a depth of 5mm, and flush pointed with similar mortar, but of pointing consistency.

Supply of Precast Concrete Units

The contractor will be permitted to obtain precast concrete units from outside suppliers provided that they comply with the Specification and that the contractor obtains the Project Manager's approval for each supplier.

Handling and Stacking of Precast Units

The contractor is to give the Project Manager full details of his proposed methods of handling and stacking precast concrete beams and units. The Project Manager will examine these details and will either approve the methods or order modifications designed to ensure that no excessive stresses are set up in the beams or units. The finally approved methods are to be adhered to at all times and the contractor shall be deemed to have included in his rates for all measures required to handle and stack beams and units safely and without undue stressing.

Tolerances

Concrete work shall be executed to the tolerances specified in the Appendices or to such other tolerances as the Project Manager may approve.

Cement Grout

Cement grout for general purposes shall consist of Portland cement and water mixed in the proportion of two parts by volume of cement and three parts by volume of water. The grout shall be used within one hour of mixing.

Cement Mortars

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

Dry Mix Concrete

Should the contractor wish to use dry mix concrete for any sections of the work, he shall submit his proposals to the Project Manager for approval. The contractor must satisfy the Project Manager that the method he proposes to use will produce a finished concrete of the specified strength and density.

Concrete Blocks

Precast concrete blocks shall be solid unless otherwise stated on the drawings and made of Class C concrete and shall comply with the aforesaid specifications and BS 6073, Part 1 "Precast concrete masonry units". Unless otherwise specified, the nominal block size shall be 450 x 225 x 150mm or 450 x 225 x 225mm. However, the contractor may with the Project Manager's approval modify the height of the block in order to simplify the building work. Blocks shall be cast in rigid steel forms and shall be allowed to cure for a period of not less than 15 days before use.

Sand/Cement Blocks

Precast sand/cement blocks shall be solid unless otherwise stated on the drawings. The nominal block size shall be 450 x 225 x 150mm or 450 x 225 x 225mm. However, the contractor may with the Project Manager's approval modify the height of the block in order to simplify the building work. Blocks shall have a minimum compressive strength of 2.8 N/mm² and shall comply with BS 6073, Part 1 "Precast concrete masonry units".

Block Masonry

(1) Block masonry shall be to the lines and levels shown on the drawings. The blocks shall be laid in a staggered pattern such that the vertical joints between two consecutive layers are offset by half a block length.

(2) Horizontal reinforcement mesh comprising typically of two R3 mild steel bars with R3 distribution bars at 200mm centres, shall be placed in the mortar on alternate courses in all irrigation structures greater than 600mm high and at three course intervals in buildings. The Contractor shall submit to the Project Manager for approval, samples of the type of block reinforcement mesh he is proposing to use.

(3) The blocks shall be wetted before laying and shall be set in mortar, which complies with the specifications given in Clause 448. Unless otherwise stated, the maximum joint thickness shall be 12mm and the horizontal and vertical joints shall be filled with mortar. Joints shall be finished flush with the face of the blocks. Block 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 work proceeds and on completion so that they are left in a neat, tidy and clean condition.

(4) Building masonry will not be permitted in heavy rain without the approval of the Project Manager. In such instances the contractor shall make provision to protect materials and the newly placed mortar from the rain.

Reinforced Cement Concrete (RCC) Pipes

Reinforced cement concrete pipes used in the works shall comply with and are to be laid in accordance with the requirements of BS 5911, "Precast concrete pipes, fittings and ancillary products". Unless otherwise specified, all RCC pipework shall be Class M with spigot and socket type flexible joints.

STONework

Stone

(1) 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 Project Manager. When required by the Project Manager, samples shall be submitted by the contractor of the stone he proposes to use in the works and the Project Manager'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 Project Manager.

(2) 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 rough on the surface shall not project more than 40mm for stone less than 0.3 sq.m face area and nor more than 60mm for larger stones.

Masonry

(1) Masonry shall be built to the lines and levels shown on the drawings. Notwithstanding any local usage it shall be built in the manner specified below and otherwise as described in BS 5390, "Code of practice for stone masonry", the terms and definitions of which shall be deemed to apply to this Contract.

(2) For face work the stones shall show a face of not less than 0.02 sq.m and not more than 0.10 sq.m in area and none shall be less than 125mm 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.

(3) For the arrises, stones shall be roughly squared, quarry split and of a size to give outbands varying from 350 to 450mm in length and inband from 150 to 250mm. The alignment of arrises shall be set true to the required lines.

(4) The stones shall be set in mortar with their natural bedding place (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 metre of wall face.

- (5) The mortar shall be, unless otherwise specified, machine mixed cement and sand in the proportion of 1:3 generally as described in these specifications. Mortar shall completely fill all interstices between the stones.
- (6) The face joints in rubble masonry may vary in thickness from 10 to 20mm. They shall be finished as a neat weathered joint with mortar while the work proceeds. Where pointing is specified, the joints in each day's work shall be raked out to a depth of not less than 25mm before the mortar has set. Subsequently the joint shall be filled with mortar and finished in accordance with Clause 509. 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.
- (7) Before a general start on a structure of large dimensions is begun the contractor will be required to build a small portion of the walling of required type and pointing for approval by the Project Manager. After approval has been given, the remainder of the work will be required to conform to the sample.
- (8) Where composite construction is specified, consisting of masonry facing with concrete backing, the concrete shall follow closely on the facing and shall be thoroughly bonded thereto. In no case shall the facing be built more than 600mm in advance of the backing and backing shall not be built up before the face work, which must not be moved by the placing of the backing concrete.
- (9) In all cases where pipes or the like are built into walls, the masonry, together with any concrete or brickwork associated therewith, shall be fitted around pipework and caulked or sealed with flexible waterproof material to prevent leakage or fracture of the pipe.
- (10) Building of masonry will not be allowed in heavy rain without the written consent of the Project Manager. Building shall only proceed when suitable precautions to the satisfaction of the Project Manager have been taken against the action of rain on newly placed mortar. If for any reason of urgency the consent of the Project Manager should be desired to a departure from these provisions,

the contractor shall submit to the Project Manager for approval his proposals for protecting the materials and work from the weather.

Type of Masonry

(1) The arrangement of the stones on the exposed face or faces on the masonry shall be squared rubble brought to courses unless shown otherwise on the drawings or directed by the Project Manager. The various types of stone masonry are described below.

(i) Random rubble un-coursed shall be built with stones of irregular shapes taken generally as they come from the quarry, preparation being limited to the removal of inconvenient comers 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.

(ii) Random rubble brought to courses shall be generally as the preceding type except that it shall be levelled up to courses between 300 and 400mm in depth and coinciding with the quoin stones.

(iii) Squared rubble un-coursed or snecked rubble shall be built of stones roughly squared to rectangular shapes of random sizes and laid un-coursed as risers and stretchers. Smaller rectangular stones, or "snecks" of not less than 100mm in any dimension, shall be included to avoid long continuous vertical joints.

(iv) Squared rubble brought to courses shall be built with the same kind of stones as for the previous type but the work shall be levelled up to courses between 300 and 450mm in depth, the courses corresponding with the height of the quoin stones.

Bedding of Masonry

Unless otherwise directed by the Project Manager, 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.

Square Rubble Coursed or Broken Coursed

Squared rubble shall consist of approved stone and of the type shown on the drawings. No stone shall be less than 225mm long, 150mm wide and 100mm deep unless otherwise shown on the drawings. All stones shall be truly squared and dressed on the beds and joints for a distance of at least 125mm from the exposed face. Bond stones shall be provided at the rate of one to every square metre of exposed face, and shall measure not less than 150mm by 150mm on the face, and not less than 500mm in length. Sneck stones shall be flat-bedded, and not less than 150mm long. Vertical joints shall not include more than three stones, and the horizontal lapping of the stones shall not be less than 100mm. The stones shall be bedded and jointed in mortar and the thickness and surface of the joints shall be as shown on the drawings.

Random Rubble Coursed or Uncoursed

Random rubble masonry shall be of the type and dimensions shown on the drawings. All stones shall be carefully set with a bond stone provided at the rate of one to every square metre of exposed face. Bond stones shall measure not less than 150mm by 150mm on the exposed face, and not less than 450mm in length or the full thickness of the wall if the latter are less than 450mm unless otherwise shown on the drawings. Stones shall be bedded in mortar, and for coursed rubble they shall be levelled off every 300 or 400mm as directed by the Project Manager, the interior then being flushed up in cement grout as specified in Clause 447. Face joints shall be raked clean and the thickness and surface of the joints shall be as shown on the drawings.

Backing to Masonry Face Work

Rubble backing to masonry face work shall be built generally to the requirements for uncoursed random rubble masonry as specified in Clause 506. Concrete backing shall be concrete Class D. No masonry face work which is to be backed with rubble or concrete shall be carried up at any time more than 600mm in advance of the backing and the backing shall not be built up before the face work, which must not be moved by the placing of the backing.

Special Stonework Including Quoins, Copings, Plinths and Voussoirs

Special stone work shall consist of approved work including 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 rubbing the joint clean and then filling it with mortar which shall be given a flush face with a steel trowel.

Hand-Placed Filling

Hand-placed rubble filling shall consist of rubble 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 place of the face.

Rubble Filling

Any filling for which "rubble filling" is specified shall be done with approved quarried rock, filling obtained from excavations within the works, from a borrow pit, or from any other source. The rock shall be dumped in such a manner that the filling will be adequately compacted.

Pitching

(1) Pitching will be used to form a revetment on horizontal or sloping ground with a thickness as stated on the drawings. It shall consist of a one-stone deep layer of hand-placed stones giving an even exposed surface. Pitching on slopes shall be built upwards from the tow unless otherwise directed by the Project Manager. A coping consisting of large flat stones shall be laid along the top of the stone pitching on slopes to produce a firm edge. Pitching shall be of one of the two types specified below:

(i) "Dry pitching" shall be pitching in which no binder is used; instead the interstices shall be wedged with spalls and filled with well rammed approved granular material or sand.

(ii) "Cemented pitching" shall be pitching in which the interstices are filled with cement mortar. The stone shall be laid in a bed of Class D concrete while it is still fresh.

(2) For all types of pitching the quality of stone shall be as specified in Clause 501. Stones shall be of random length and width but no stone shall be of less volume than 0.01 cu.m nor of less thickness than that specified for the pitching. The sides of all stones shall be roughly hammer dressed to obtain a reasonably close stone to stone fit.

(3) The ground on which the pitching is constructed shall be well consolidated and formed to an even surface. The ground bed for dry pitching shall consist of a 150mm thick layer or other stated thickness of approved granular or fine filter material. Representative samples of the proposed bedding materials of not less than 25kg shall be supplied to the Project Manager for his approval before work commences and each time the source or quality of the materials is altered. The source of the materials shall be approved by the Project Manager. For cemented pitching the bed shall consist of 100mm of Class D concrete. On this bed the stones shall be placed, each set firmly with their natural cleavage plane at right angles to the exposed surface to give an even face with broken joints and a uniformly random appearance.

Tipped Rock

(1) Tipped rock shall consist of selected hard durable rock free from weathered or decomposed parts to the approval of the Project Manager, containing no flaky stone and being well graded within the limits shown below.

(2) The class of tipped rock and the thickness of the layer shall be as shown on the drawings.

Class	Size of stone "d" (mm)	Percentage by weight smaller than stone size "d"
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A	300	100
	125	40 - 55
	45	0
B	150	100
	63	40 - 55
	31	0

(3) Tipped rock shall be placed in an approved manner in order to produce a uniform well knit unsegregated layer in which all sizes are held in position.

(4) The Contractor shall submit bulk samples of not less than 1.5 cu.m of each class of rock for approval by the Project Manager 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.

Gabions

(1) 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, "Mild steel wire for general engineering purposes", galvanized in accordance with BS 443, "Testing zinc coatings on steel wire and for quality requirement". The wire shall be of 2.7mm diameter with a polyvinyl chloride (PVC) coating not less than 0.5mm thick and formed into a fabric having a mesh of 80mm by 100mm for baskets and 60mm by 80mm for mattresses. Gabions shall be assembled and erected in accordance with the manufacturer's instructions.

(2) 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 120 to 80mm, for baskets the stone shall be 250 to 100mm. The stone shall be obtained from a source approved by the Project Manager. 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.

(3) The empty gabions shall be placed to line and level as shown on the drawings or as directed by the Project Manager 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 600mm intervals for mattresses. The gabions shall be filled with approved stone as specified in (2) above. No basket or mattress forming part of an intended continuous line of gabions shall be completely filled until an adjacent basket or mattress has been half filled, unless otherwise directed, in order not to cause displacements from bulging during filling.

(4) 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 330mm and 660mm 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 40mm. 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 galvanized, PVC coated and of the same gauge as the gabion mesh wire specified in (1) above.

Filter Fabric

The filter fabric shall be of a non-woven welded fabric consisting of a mixture of polypropylene and polythene or other similar materials. The grade of fabric shall weigh not less than 140 gm/m² and have a thickness of 0.5mm. Where overlapping of fabric is required, the overlap shall not be less than 500mm. The quality of a filter fabric shall be approved by the Project Manager before use.

Graded Filters

- (1) The graded filters shall be of a thickness shown on the drawings and shall consist of stone graded to meet the requirements indicated below.

Class	Size of particle "d" (mm)	Percentage by weight smaller than particle size "d"
A	63	100
	31	70 - 100
	8	25 - 70
	2	0 - 25
	1.4	0
B	16	100
	4	64 - 100
	1	15 - 64
	0.25	0 - 15
	0.09	0

- (2) 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.

Gravel

- (1) Gravel shall be clean, hard and well graded from 5 to 37mm size and shall be clean, hard and durable rock fragments.

PIPEWORK AND MISCELLANEOUS

Pipe Materials

(1) Pipes supplied and all associated accessories shall be new, obtained from a manufacturer approved by the Project Manager and shall comply strictly with the relevant standards stated in the following clauses, however the ISO standard will be preferred the flanges, saddles, couplings shall always follow the ISO standard, unless otherwise approved by the Project Manager. Where any conflicts arise among the specifications in this Part 6, the ISO standard shall have the precedence. The Contractor shall submit his plans of using the standards for each part of the pipe materials before the manufacturing and shipping for approval by the Project Manager.

(2) In addition to any other requirements all equipment supplied under the contract shall be designed and manufactured so as to withstand field test pressures as indicated in the specification.

Identification Marking

(1) All pipes and fittings shall be legibly and conspicuously marked with the manufacturer's name or identification mark, the date of manufacture, the nominal bore and class of pipe, after the application or any factory applied protective treatment specified.

(2) For any item which is too small to permit the number to be painted on it, a waterproof label carrying the information in waterproof ink may instead be wired to the item.

PVC Pipes, Tees, Reducers and Bends

(1) PVC pipes, tees, reducers and bends shall be unplasticised polyvinyl chloride complying with BS 3505, "unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water", and shall be obtained from an approved manufacturer. Pipes shall not exceed 6m in length. Joints in PVC pipework shall unless otherwise approved by the Project Manager, be flexible of the push-on spigot and socket type with rubber ring gaskets, complying with BS 4346, "Joints and fittings for use with unplasticized PVC pressure pipes".

- (2) Threaded steel fittings used in conjunction with PVC pipes shall be manufactured to comply with BS 1740, Part, "wrought steel pipe fittings". All dimensions for the screwed ends of fittings shall be in accordance with Table 1.
- (3) Mechanical joints and fittings of the push-fit type made principally for PVC pressure pipe shall comply with BS 3505.
- (4) Insertion length of joints shall comply with BS 4346, Part 2.
- (5) Flange adapters shall be of PN10 and comply with BS 4504, "Circular flanges for pipes, valves and fittings", Section 3.1, Table 1 for steel flanges or Section 3.2, Table 1 for cast iron flanges.
- (6) Riser tees shall be cast steel, cast iron or aluminium, with mechanical push-fit type joints to the PVC-U pipe and threaded BSP socket outlet to BS 21, "Pipe threads for tubes and fittings where pressure-tight joints are made on the threads" for the hydrant.

PE pipes, Tees, Reducers and Bends

- (1) PE pipes, tees, reducers and bends shall be polyethylene complying with acceptable standards for cold portable water, and the qualities shall be all subject to the approval by the Project Manager. A piece of Pipe shall not exceed 6 m in length with the working pressure of 10 bar or more. The maximum pressure the pipe can withstand for a short period of 3 hours shall not be less than three (3) times the working pressure. The Manning's roughness coefficient of the pipe shall be 0.01 at most.
- (2) Flange adapters shall be according to the ISO standard.
- (3) Riser tees shall be galvanised milled steel with plastic saddle joints to the PE pipe, and threaded socket outlet according to the ISO standard.

Asbestos Cement Pressure Pipes

- (1) Asbestos cement pressure pipes and joints shall comply with BS 486, "Asbestos cement pressure pipe and joints" and shall be supplied with collar joints. Fittings for asbestos cement pipes

shall be cast iron and comply with BS 4622, "Grey iron pipes and fittings". Flexible mechanical couplings shall comprise cast iron detachable flanges and collars with rubber seals. The seals shall be rubber and comply with BS 2494, "Elastomeric seals for joints in pipework and pipelines". The joints shall be assembled and tightened in accordance with the manufacturer's instructions. All fittings and joints shall have pressure rating equal or greater than that specified for the pipes. All cast iron fittings shall be internally and externally coated with bituminous solution suitable for use with potable water pipelines. The classification, characteristics and size shall be as shown on the Drawings. The pipes will generally be 4 m in length.

(2) Two complete sets of special tools for cutting, trimming and joining AC pipes will be provided by the pipe manufacturer to the Contractor against a receipt. All the tools must be returned in good working condition. Failure to do so will result in the Contractor reimbursing the pipe manufacturer the full cost of replacing any defective equipment.

Steel Pipes

(1) Steel pipes shall comply with BS 3601, "Carbon steel pipes and tubes with specified room temperature properties for pressure purposes." Steel pipes, joints and specials for water and sewage", Table 1. Joints shall be butt welded or flanged as shown in the Drawing or as directed by the Project Manager.

(2) Butt welded joints and sleeve joints for welding shall be in accordance with BS 534. The end tolerances for both types of joint shall be within the limits given in BS 534.

(3) Steel pipes and fittings greater than 100mm diameter shall be flanged unless otherwise shown in the Drawings or directed by the Project Manager. Steel flanges shall be of the weld-on type and shall comply with BS 4504, "Circular flanges for pipes, valves and fittings (PN designated)". The pressure rating shall be PN10 unless otherwise stated. Gaskets for flanged joint shall be of fabric reinforced rubber of the full face type and comply with BS 4865, "Specification for non-metallic flat gaskets (including gaskets for flanges to BS 4772)", Part 1. The joints shall be made using bolts and nuts to BS 4190, "ISO metric black hexagon bolts, screws and nuts". Washers shall comply with BS 4320, "Metal washers for general engineering purposes (metric series)".

Galvanized Mild Steel Pressure Pipes

- (1) Galvanized mild steel pipes shall be medium or heavy duty gauge in accordance with BS 1387, "Screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads". Unless shown otherwise on the Drawings or directed by the Project Manager, pipe fittings up to and including 100mm diameter shall have BSP threads and shall comply with BS 1740, Part 1. Joints on pipes greater than 100mm diameter shall be flanged in accordance with Clause 605(3).
- (2) Threaded fittings for galvanized mild steel pipes shall comply with BS 1740: Part 1, "Wrought steel pipe fittings".

Pipe Specials

- (1) Where pipe specials are to be fabricated, preparation and welding shall be carried out in accordance with BS 2633. Specials shall be jointed as shown in the Drawings or as directed by the Project Manager.
- (2) Bends up to and including 300mm shall have a smooth radius in accordance with BS 534, Table 7. Diameters greater than 300mm shall be gusseted bends, fabricated in accordance with BS 534, Table 8.
- (3) Dimensions of tees shall comply with BS 543, Table 9.

Steel Pipe Coating

- (1) Before the application of external coating, pipes and specials shall be primed with a compatible priming coat. Material and methods complying with BS 4174 or BS 4164 shall be used as appropriate.
- (2) Coating of steel pipes shall be applied by using bitumen sheathing consists of natural or blown petroleum bitumen mixed with an inert filler, i.e. Type 2 or Type 3 in accordance with BS 4147.
- (3) The pipes and specials shall be covered with a layer of sheathing material, applied as hot

coating or mastic to provide a seamless, consolidated and smooth layer having a minimum thickness as given in BS 534, Table 10.

Steel Pipe Lining

- (1) Before internal protection is applied, pipes and specials shall be primed with a compatible priming coat. Material and methods complying with BS 4174 or BS 4164 shall be used as appropriate.
- (2) The lining materials shall consist of a uniform blend of natural or blown petroleum bitumen mixed with an inert filler to produce homogeneous composition of Type 3 in accordance with BS 4147.
- (3) The lining material, in a hot fluid condition, shall be applied centrifugally to straight length of pipe to give a smooth continuous lining, having a minimum thickness in accordance with BS 534, Table 12.

Flexible Couplings

Flexible couplings used to form joints adjacent to structures and else where as shown on the Drawings or required by the Project Manager, shall be according to the ISO standard. They shall include all necessary bolts and gaskets, and be of appropriate pressure rating and dimensions for the pipes they join.

Dismantling Joints

Dismantling joints shall allow the quick and easy pipeline modification and the dismantling of flanged pipework and fittings. The joints shall be according to the ISO standard., comprising a flange adapter, flanged spigot piece and tie bars, and be of the same pressure rating and dimensions as the pipes they join. The position of the joints is as shown on the Drawings or required by the Project Manager.

Flange Adapters

Flange adapters shall be according to the ISO standard, and shall be approved by the Project Manager before the manufacturing and use. They shall be provided with the necessary bolts and gaskets. Flange

adapter joints shall have the same pressure rating as the pipes they connect.

Cast Iron Gate Valves

- (1) Cast iron gate valves shall be suitable for a working pressure of 10 bar and filed test pressure of 15 bar, complying with the requirements of BS 5150, "Cast iron gate valves".
- (2) The valves shall have PN10 flanged connections to BS 4504, "Circular flanges for pipes, valves and fittings."
- (3) O-ring stuffing boxes may be used.
- (4) The valves shall be iron body, wedge gate or resilient seal type.
- (5) All gate valves shall have non-rising stems and shall open counterclockwise.
- (6) Unless otherwise stated each valve shall be supplied with a valve cap secured by a hexagon headed set screw. Where extension spindles are required, these shall be obtained from the valve manufacturer.

Cast Iron Check Valves

- (1) Check and foot valves shall be of the single and foot valves disk, non-slamming swing type designed to allow a full diameter passage and to operate with a minimum loss of pressure.
- (2) Check and foot valves shall be suitable for a working pressure of 10 bar and filed test pressure of 15 bar, complying with the requirements of BS 5153, "Cast iron check valves for general purposes". With pressure rating of PN10.
- (3) Check and foot valves shall have bronze renewable seal rings, bronze disk rings and bronze hinges and stainless steel pins. Valves shall be supplied with iron disks with bronze rings attached. Pins, disks and other parts shall be corrosion resistant and non-sticking.

- (4) The valves shall have PN10 flanged connection to BS 4504.

Copper Alloy Valves

Check valves and gate valves up to and including 100mm diameter shall be constructed of high quality brass, or bronze and be suitable for a working pressure of 10 bar and conform to BS 5154, Series B "Copper alloy globe, globe stop and check gate valves". The valves shall have female BSP threaded inlet/outlet ports in accordance with BS 21.

Foot Valves

The foot valve shall be constructed of galvanized steel, copper alloy or aluminum with hinged steel clack and rubber seats. The valve shall have an integral strainer with a maximum mesh size of 8mm and the head loss across the valve shall not exceed 0.1 bar. Valves up to and including 100mm shall have BSP threaded connection, larger diameters shall be flanged.

Air Relief Valves

(1) Cast iron double orifice air relief valves shall be provided on the pump delivery manifold pipe at all permanent pumping installations and at points along the rising main, where directed by the Project Manager. The valves shall be designed to exhaust large amounts of air during filling and release small amounts of accumulated air during operation and admit large amounts of air upon impending vacuum during draining. The valve body and cover shall be cast iron, the orifice bracket and cover shall be glass filled nylon and the float, float guide and lever ABS (Acrylonitrile Butadiene Styrene). The valves shall have a pressure rating of 10 bar.

(2) Large orifice air relief valves shall be provided at points where a vacuum may occur in the system, for example adjacent to valves or at the end of a pipeline with hydrants. The body shall be made of copper alloy or cast iron with an ABS (or similar) float. The valve shall have a working pressure rating of PN10 and inlet port shall be a 25mm male BSP thread to BS 21.

Hydrant Plumbing

Pipework to hydrants shall be galvanized mild steel of 50, 80 or 100mm nominal bore, screw jointed as specified in the Bill of Quantities. Pipe threads shall be in accordance with BS 21, "Pipe threads for tubes and fittings".

Pressure Relief Valve

A pressure relief valve shall be provided on the pump delivery manifold pipe on all permanent pumping installations to protect the rising main and fittings from excessive pressure under all possible operating scenarios. The valve body shall be made of cast steel with PN10 flange connection to BS 4504 unless otherwise stated on the Drawings. The unit shall be preset at the factory to blow-off at the required pressure and there shall be no means of making on-site adjustments. The valve shall have a smooth, but rapid response.

Pressure Gauges

Pressure gauges shall be liquid filled, bourbon tube type and comply with BS 1780, "Bourbon type pressure and vacuum gauges". The gauge shall have a 100 mm diameter case and a pressure range of 0 to 16 bar. The scale shall extend over approximately 270° and have 0.5 bar graduations. The gauge shall be fitted with a blow-out device and have a bottom male BSP threaded connection. Portable pressure gauges shall be connected to the end of a 1m length of high pressure hose (10 bar working pressure), the other end of which is fitted with a quick connect hose fitting for simple connection and disconnection to a Schrader valve.

Layflat Hose

Layflat hose shall be reinforced plastic or other approved abrasion resistant material. The hose shall be sufficiently flexible to allow it to be rolled into a tight coil and shall not be damaged when squashed flat or kinked. The working pressure of the hose shall be 3 bar. The hose shall be connected to the male part of a quick coupling joint via a hosetail and secured by a suitable hose clamp.

Pipe Handling

- (1) During loading, transportation and unloading care shall be taken to prevent injury to the pipes,

surface finish and protective coating. Loading and unloading shall be done item by item with ropes and skids or suitable power equipment, if necessary, and the pipe shall be under perfect control at all times. Under no condition shall pipes be dropped, bumped, dragged or allowed to roll together. When handling the pipe with a crane, a rope with a double-bight sling around the pipe shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Under no condition shall pipe hooks or a sling through the pipe be used. The pipe shall be securely wedged during transportation to reduce to a minimum any possible damage to the pipe.

(2) Pipe spigots shall be adequately protected during transportation.

(3) In laying out, pipes and specials shall not be allowed to impede or harm traffic or animals or to obstruct paths and access to private and other property. Pipes shall not be laid out in beds of ditches and every precaution shall be taken to preserve their cleanliness before laying.

Pipe Storage

When pipes are stored prior to laying out, they shall be placed neatly in stacks in strict accordance with the manufacturer's recommendations.

Trench Depths

(1) Trenches for pipes shall be excavated to a sufficient depth to ensure, after consolidation of the backfill, a normal minimum depth of cover from the ground surface to the top of the pipe of 800mm in open ground and 1000mm beneath roads and the bed of grass waterways. Where the pipeline is required to be laid to a lesser depth the pipe shall be protected as directed by the Project Manager.

(2) Unless directed by the Project Manager, maximum depth of ground cover to the top of the pipe should not exceed 2000mm.

(3) Where pipes are to be laid in an embankment, the embankment shall first be constructed to full height to provide cover to the pipe, and the embankment subsequently excavated as detailed above.

Care shall be taken to ensure that pipes are not subjected to traffic loads until the minimum cover has been established.

Bedding of Pipes

- (1) Where the natural ground in the bottom of the trench is, in the opinion of the Project Manager, free from stones and other unsuitable material, the pipes may be laid directly on the bed of the trench. Holes shall be excavated at each joint and the bottom of the trench shall be accurately trimmed to the required level to ensure the barrel of the pipe is fully supported along its entire length. Pipes shall be surrounded in selected excavated material as shown on the drawings, fully and carefully compacted around the pipe circumference. Excavated material selected for surround shall be uniform, readily compactable material free from tree roots, vegetable matter, building rubbish, stones and lumps retained on a 25mm sieve.
- (2) Where directed by the Project Manager the trench shall be over excavated and pipes shall bedded and surrounded in granular material of 14mm maximum particle size, no more than 5 percent of which passes through a 5mm BS Sieve.
- (3) The bedding and surround to the pipes shall be thoroughly compacted. The pipes shall be laid evenly on the barrel at the required level. There should be no hollows, voids or foreign material under the pipe. No concrete blocks or wedges may be used. The bedding should be completed to the correct profile.
- (4) Particular care must be taken to ensure that proper bedding is obtained under and on either side of the pipe joints. Where pipe jointing holes are left in the bedding, particular care must be taken to ensure complete and proper filling of the holes after pipe testing.
- (5) The trenches shall only be bottomed up immediately in advance of pipe laying but no pipes shall be laid until a distance of at least 3m along the trench has been prepared and bottomed up to receive the pipes, unless specially permitted otherwise by the Project Manager.

Temporary Stoppers

Properly fitted, temporary wooden stoppers shall be provided and constantly used to close the ends of all uncompleted pipelines. The stoppers are only to be removed when pipes are being laid and jointed.

Pipe Installation

- (1) All pipes shall be carefully brushed out inside and shall be checked for soundness before being laid.
- (2) Each pipe shall be carefully lowered into its prepared bed by means of the necessary slings and tackle. If the prepared bed is damaged, and if stones are dislodged into the trench, the pipe shall be raised and the bed made good and stones removed before pipe laying is continued.
- (3) In no case shall pipes be jointed before being lowered into the trench, unless previously agreed to by the Project Manager.
- (4) Pipes shall be laid separately to true inverts, straight lines and falls, each pipe being separately boned between sight tails and bearing evenly upon bed of the trench, or the bedding where provided, for its full length. No water from the trenches shall be allowed to enter the new pipes and no refilling of trenches will be allowed until the joint of the pipes has been inspected and approved. The trenches and joint holes shall be kept free from water until the pipes are laid, jointed and partially backfilled.
- (5) Pipes shall be jointed strictly in accordance with the manufacturer's instructions and with the correct lubricant where appropriate. Pipes shall be laid on bedding where directed by the Project Manager. Pipes shall not be laid in direct contact with other one another but shall be protected by an intervening layer, 150 mm thick, of consolidated soft material. When cut pipes are used, the spigot ends shall be chamfered in accordance with the manufacturer's instructions.

Backfilling Around and Over Pipes

- (1) After the pipes have been laid and checked selected material shall be carefully placed into the spaces between the pipe and the sides of the trench to the level of the crown of pipe. The material shall

be placed in layers not exceeding 150mm (before compaction) and thoroughly packed and rammed by careful hand tamping. The placing and tamping of the material shall proceed equally on both sides of the pipe.

(2) The bedding shall be completed by placing similar selected material at least 100mm deep after compaction by hand to the full width of the trench over the crown of the pipe.

Backfilling of Trenches

(1) Backfill material shall comprise excavated material excluding lumps and stones retained on a 75mm sieve.

(2) No excavated material, which in the opinion of Project Manager, is or has become unsuitable shall be used for backfilling purposes.

(3) Backfilling shall wherever practicable be undertaken immediately the specified operations preceding it have been completed.

(4) The pipeline trenches may be partially backfilled before testing but joints shall be left exposed. The backfilling shall not be completed until the pipeline has been tested to the satisfaction of the Project Manager.

(5) Backfill material above 100mm over the crown of the pipe shall be deposited in layers each not exceeding 225mm thickness, each layer being thoroughly compacted.

Surface Restoration

(1) The Contractor shall restore and maintain all land surfaces to the approval of the Project Manager.

(2) Upon completion of backfilling, all rubbish, surplus material, etc, shall be cleared from the Site.

(3) One restoration work has commenced, no construction traffic shall pass over the ground, and the restoration work itself shall be carried out in a manner as to avoid unnecessary passage of vehicles over restored ground.

Pipes Built into Structures

(1) The outside surface of all pipes and special castings to be built into structures shall be thoroughly cleaned immediately before installation. Protective coatings to metal pipes shall be removed from the sections to be built in. PVC-U or PE pipes shall not be built into structures unless directed by the Project Manager.

(2) Unless otherwise directed by the Project Manager, a steel plates welded on 1 m long steel pipe for water-tightness shall be provided on all pipelines built into structures.

(3) Pipes passing through walls and floors of water retaining structures shall be built into the structure in-situ. Shuttering shall be formed closely to the outside of the pipe, and concrete shall be placed and compacted thoroughly round the pipe and puddle flange where provided.

(4) Flanged pipes through walls shall be arranged with the bolt holes symmetrically off-centre unless directed otherwise.

Anchor and Thrust Blocks

(1) All tees, bends, valves and specials where unrestrained thrusts may occur shall be securely anchored with Class B concrete blocks as detailed in the Drawings or as directed by the Project Manager.

(2) The blocks shall bear against undisturbed ground. In the case of horizontal bends, the bearing surface shall be normal to and symmetrical about the direction of thrust. For vertical bends, blocks shall bear upon horizontal and vertical planes.

- (3) Concrete to thrust blocks may only be poured after the Project Manager has approved the excavated and formwork.

Testing Pressure Pipes

6.1 Selected PVC-U and PE pipes shall be tested hydraulically at the place of manufacture before every delivery is made all at the attendance of the Project personnel.

6.2 All pipelines operating under pressure shall be tested hydraulically in sections during the course of construction all at the attendance of the Project personnel.

- (3) Testing shall be applied to prove the structural soundness and watertightness of the various units in the line including pipes, valves and anchorages.
- (4) The test pressure to be applied to each pipeline shall be as directed by the Project Manager. The test at the laboratory before the delivery shall be done using the working pressure as well as the maximum pressure. The maximum pressure shall be 3 times of the working pressure.
- (5) Tests shall be applied to sections of pipeline not exceeding 1000m in length, or such lesser length as may be required.
- (6) The Contractor shall provide pumps, gauges, jacks, struts, and all apparatus necessary for carrying out the tests and shall keep them in good order. The gauges shall be tested to the satisfaction of the Project Manager.
- (7) The Contractor shall provide for transmitting the unsupported end thrusts to solid ground at the ends or into the sides of the trenches. Testing shall not be permitted against a closed valve.
- (8) Before testing, the Contractor shall ensure that the anchorage of bends is complete and that all branch outlets taking end thrusts are properly stayed.

- (9) Water required for filling the main shall be provided by the Contractor and obtained from an approved source.
- (10) The Contractor shall give the Project Manager not less than three (3) days notice of his intention to test a section of pipeline.
- (11) To test, the pipeline shall be charged with water and all air released. The length to be tested shall be filled slowly and allowed to stand for a sufficient period to allow air to be liberated before the test is commenced. Free outlets for air shall be provided. The pressure shall then be increased to the test pressure and maintained for a period of three hours. At the end of the three hour test any loss of pressure shall be made good by pumping water into the pipeline and the quantity of water required shall not exceed the rate of 0.1 litres per millimetre nominal internal diameter per kilometre length of main per 30 metres head for each 24 hours. Should this rate be exceeded then the Contractor shall locate and repair the leaks and repeat the test at his own expense.
- (12) The test on each section shall be repeated until the specified degree of water tightness has been obtained.
- (13) The Contractor shall ensure that no erosion, pollution or silting occurs in watercourses from the discharge of test water.
- (14) Notwithstanding that any or all sections may have passed the above described test, the Contractor shall remain liable for handing over all mains in a watertight condition at the end of the maintenance period.

MISCELLANEOUS

Cast Iron

- (1) Steel casting shall comply with BS 3100, "Steel castings for general engineering purposes". All castings shall be carefully moulded to the form and dimensions shown on the drawings and shall present true and clean surfaces free from all defects.
- (2) Subject to the prior agreement of the Project Manager defects in the casting may be rectified by welding. Notwithstanding such prior agreement to the use of welding, the Project Manager may reject any finished welded casting should he not be satisfied as to its soundness.
- (3) If called by the Project Manager, non-destructive tests on the castings shall be carried out by the Contractor.

Drawings to be Submitted and Tests to be Carried Out by the Contractor

- (1) The Contractor shall arrange for the submission of shop drawings for the whole of the steelwork to the Project Manager for his approval. All such drawings shall show the dimensions of all parts, method of construction, spacing of rivets, welding sectional areas and all other details. No materials shall be ordered nor fabrication commenced until such drawings are approved by the Project Manager in writing.
- (2) Tests as required under the standards quoted for steel to be used in the Works shall be carried out in the presence of the Project Manager or his Representative and at least four days notice must be given to him before the dates proposed for such tests. At least four days clear notice shall also be given of the date on which fabricated steelwork will be ready for inspection in the fabricator's works.

Permanent Fencing

- (1) Fencing other than security fencing shall be timber post and barbed wire.
- (2) Posts shall be round posts of an approved timber. All bark shall be stripped and the posts

stacked to air dry for at least 3 weeks before being treated by steeping in an approved tar oil preservative for a minimum period of 24 hours.

- (3) Posts shall be 2m long and a minimum girth of 375mm for line posts, and shall be pile driven into the ground so that the tops of the posts are 1600mm above ground level.
- (4) Posts shall be placed at no more than 3m interval with intermediate straining posts at intervals not exceeding 66m in straight lengths of fences.
- (5) Corner, end and intermediate straining posts shall be adequately braced.
- (6) Line wire shall be bared wire of 2 ply, 2.5 mm diameter steel wire with 4 point barbs at intervals of 75 mm. It shall be galvanized to meet the requirement of BS 443, "Galvanized coatings on wire". Six line wires shall be fixed at intervals of 75, 325, 575, 825, 1075 and 1325 mm from the top of the posts. Each line shall be fixed to each post by one 37.5 mm x 4 mm diameter galvanized staple.

Painting Concrete

- (1) Where directed by the Project Manager concrete surfaces due to come into contact with corrosive water shall be painted with two coats of approved bituminous paint, the first coat being a bituminous primer and the second coat a heavy bodied black bituminous solution. Both coats are to be applied on a dry and dust free surface.
- (2) Where directed by the Project Manager other concrete surfaces shall be painted with two coats of an approved cement paint of approved colour and having an epoxy resin binder.

Painting Steelwork Subject to Immersion in Water

- (1) Steelwork, subject to immersion in water, is to be sand blasted and immediately coated with a

rust inhibitive primer, which is to be followed by two coats of coal tar epoxy or pitch polyurethane to a thickness of 0.25 mm.

(2) After erection, the steelwork shall be painted with a further two coats of a similar paint to a total thickness of 0.40 mm.

Painting Galvanized Steelwork

(1) All painted galvanized steelwork is to be painted under factory conditions as follows:

(i) One coat etching primer

(ii) One coat calcium plumbate primer

(2) All galvanized steelwork is to be protected further at the Site as follows:

(i) All bare metal at site welds, etc. is to be sand blasted and sprayed with zinc to a thickness of 0.08 mm applied in accordance with BS 2569, "Sprayed metal coatings" Part 1.

(ii) All areas treated in accordance with Subclause (2) (i) above and all other damages areas of paintwork shall be made good and painted, as the case may be, to ensure that the full two coat treatment specified in Subclause (1) above has been achieved on all surfaces.

(iii) Apply one final coat of micaceous iron oxide of one undercoat and one finishing coat of gloss enamel or alkyd resin to all surfaces after erection. The colour of the final coat is to be approved by the Project Manager.

(3) Surfaces of steelwork to be covered with concrete are to be thoroughly cleaned and free from all dirt immediately before the concrete is placed in position. Steelwork is to be sealed at the junction with the concrete surface by a bead of alkali resistant mastic after concreting and before applying the final coat of paint.

Painting Other Steelwork

(1) Where steelwork, which is not galvanized and not subject to immersion in water, is required to be painted, it shall be sand blasted and painted under factory conditions as follows:

- (i) One coat of epoxy primer
- (ii) One coat of red lead primer
- (iii) One coat of micaceous iron oxide paint

(2) The steelwork is to be further protected at the Site as follows:

- (i) All damaged paintwork to be repaired and made good to ensure that the full three coat treatment has been achieved on all surfaces.
- (ii) Apply one final coat of micaceous iron oxide or one undercoat and one finishing coat of gloss enamel or alkyd resin to all surfaces after erection. The colour of the final coat is to be approved by the Project Manager.

Galvanizing

All steel and ironwork of whatever kind described to be galvanized is to be pickled in dilute hydrochloric acid and then washed, fluxed and stoved and coated with zinc by means of dipping in a bath of molten zinc. All articles are to be immersed in the bath only for the time sufficient for them to attain the temperature of the bath and they're to be withdrawn at such a speed that a coating of 30 micron thickness on each face is achieved. The galvanizing is to be done in all cases after fabrication of the steelwork including any drilling, chipping, trimming, filling, fitting welding or bending is completed. Every article is to be covered evenly on all sides. Where applicable the galvanizing shall be such as to conform with the tests given in BS 729, "Hot dip galvanized coatings on iron and steel articles".

Bitumen Sheeting and Felting

Bitumen sheeting and felting shall be manufactured from bitumen reinforced with closely woven bitumen saturated hessian and shall be of the weight shown on the Drawings or directed by the Project

Manager.

Electric Welding

- (1) All welding shall be carried out in an efficient manner by tested and fully qualified workmen, who shall be equipped with plant and tools suitable for the purposes.
- (2) The detailed sequence and scheme of welding, and the type of electrode proposed to be used for the work shall be submitted to the Project Manager for approval before any welding is commenced.
- (3) All parts to be welded shall be accurately prepared so that on assembly they will fit closely together, and the surfaces shall be kept clean and free from extraneous matter. Following proper alignment the parts to be welded shall be securely fixed in position by the use of clips, cramps, jigs or other approved methods. Tack welding shall be restricted to a minimum. Tack welds shall not be of greater size than the final welds, and the final welds shall fuse completely with the tack welds.
- (4) Suitable allowance for contraction during welding must be made in the lengths of the steel parts before welding, so that the finished length will be correct within normally acceptable limits. If any permanent distortion or evidence of excessive shrinkage stresses become apparent the necessary cutting out and re-welding shall be carried out to the satisfaction of the Project Manager.
- (5) All welds shall be made with the proper number of runs. The finished welds shall be sound and free from all cracks, uniform and free from undercutting and slag inclusions, and shall be finished full. All slag and other deposits shall be carefully removed from the exposed surfaces immediately following each run, and before applying the next layer of weld metal.

Floor Screed

Where specified, floor screed shall be of 1:3 cement/sand mortar and shall comply with the requirements of BS 8204: "In situ floorings."

Rendering and Plastering

- (1) Internal plastering, where specified on the drawings, shall be carried out in accordance with

BS 5492 "Code of Practice for internal plastering".

6.3 Cement shall be ordinary Portland cement complying with BS 12 "Portland cement". Lime shall be soaked hydrated lime complying with BS 890 "Building limes". Hydrated lime shall be added to water, stirred to a creamy consistency and left to mature for at least 16 hours before use. Alternatively, ready slaked lime may be obtained from approved sources. The lime putty shall be protected from drying out. Sand shall comply with BS 1198-1200 "Building sands from natural sources".

- (3) All plasters, lime and cement shall be stored in a properly-roofed, weather-proof, dry, well-ventilated shed. All sand shall be stored separately, according to type, on clean, hard, dry standing and shall be protected from contamination.
- (4) Concrete, brickwork and block work walls shall be left for 28 days, or such other time as may be approved by the Project Manager, before the application of rendering or plaster. All surfaces shall be thoroughly brushed down to remove all dust and loose material. Mould oil or other deleterious substances shall be cleaned from concrete surfaces prior to rendering or plastering. Concrete surfaces shall be suitably treated to provide a good key and brickwork and blockwork joints raked out to a depth of 13mm. Low spots and areas shall be dubbed out and sufficient time allowed for the dubbing to dry out the rendering or plaster is applied. All surfaces shall be moistened immediately prior to rendering or plastering and each undercoat shall be scored to form an adequate key for subsequent coats. Each coat shall be kept moist for at least 48 hours and adequate time shall be allowed for thorough drying out to allow for complete shrinkage before the application of the setting coat. Rapid drying out shall be avoided. Conduits, cables, pipes, etc, not surface mounted shall be fixed before the rendering or plaster is applied.
- (5) All uneven surfaces shall be dubbed out locally with 1:3 cement/sand mix and scored to give a surface suitable to receive succeeding coats. No more than 10mm thickness shall be applied at one time and the requirements for curing and drying time shall be the same as for undercoat work.

(6) All internal plastering shown on the Drawings, unless otherwise stated shall consist of three coats built up to a total thickness of 20mm. The first coat shall consist of one part Portland cement to two parts sand by volume mixed with water to give a thin slurry which shall be thrown by hand to cover the blockwork with a thin knobby layer. The second shall consist of one part cement, one part lime and six parts of sand by volume in one coat approximately 15mm thick. One third coat shall consist of one part lime to two part sand by volume in one coat 5mm thick. The surface of the second coat shall be dry brushed and then damped down before the application of the setting coat. The setting coat shall have a steel float finish to true planes and regular curves and to an even and polished surface. The setting coat shall be kept damp for at least 7 days after its application.

(7) All arrises shall be finished true and slightly rounded except where otherwise stated and shall be run at the same time as the adjoining plaster. Where shown on the Drawings, arrises shall be protected by aluminum angles, as detailed, securely fixed to the underlying blocks by stainless steel screws and plastic plugs.

(8) Where waterproof rendering is shown on the Drawings or directed by the Project Manager, this shall consist of three coats built up to a total thickness of 20 mm. The first coat shall consist of one part Portland cement to two parts of sand by volume mixed with water to give a thin slurry which shall be thrown by hand to cover the blockwork with a thin knobby layer. The second coat shall consist of one part cement to 4 parts sand by volume in one coat approximately 10mm thick. The third coat shall consist of one part cement to 4 parts sand by volume with the addition of an approved waterproofing agent and approximately 10mm thick.

(9) The setting coat shall be applied with a wood skimming float and traversed with a floating rule to give a true and even surface. The setting coat shall be kept damp for at least 7 days after is application.

(10) The contractor shall cut out and make good cracks, blisters and other defects and leave the whole of work perfect on completion. When making good defects, the plaster shall be cut out to a rectangular shape with edges undercut to form a dovetailed key, and the repair finished flush with the

face of the surrounding plaster.

Carpentry, Joinery and Ironmongery

(1) All softwood for carpentry and joinery work shall be well seasoned, sound, bright, free from shakes, large loose or dead knots, waney edges, warp, incipient decay, stained sapwood, or other defects and shall be to the approval of the Project Manager. The timber shall as appropriate comply with the requirements of BS Code of Practice 112, Part 2 "The structural use of timber. Timber for carpentry work shall be carefully sawn square and shall hold the full dimensions shown on the Drawings. All sizes shown on Drawings are finished sizes unless otherwise stated. The timber shall be cut to size and shape, properly jointed and assembled including forming, gluing, doweling, screwing and mortising. All concealed surfaces of softwood joinery shall be primed. Timber for joinery work shall be finished wrought to the exact sizes shown on the Drawings with pencil rounded exposed arrises and no joinery shall be built in until inspected and approved. The whole of the hardwood joinery shall be rubbed down to a smooth surface and left clean and ready to receive a polished finish. All timber and timber derived products shall be treated with an approved anti-termite preparation.

(2) Before commencing work the Contractor shall submit samples of all types of timber to be used for the approval of the Project Manager. Timber, or carpentry and joinery units, whose material on delivery to the site does not conform to the standard of approved samples will be rejected and replaced by the Contractor at his own expense.

(3) Timber to be built in to masonry, brickwork or concrete shall be treated with two coats of an approved preservative before being built in. Reasonable tolerance is to be provided by the Contractor at all connections between carpentry or joinery work and the building carcass in order that any irregularities, settlements, or other movements shall be adequately compensated for, and he shall be responsible for adjusting the overall dimensions of carpentry and joinery work to actual structural measurements made at the site as the work proceeds. The whole of the joinery work shall be cut and formed together as soon as practicable after commencement of the Contract, and shall be finally wedged and glued immediately before fixing in position. All joinery work shall be prepared as

specified before leaving the workshop.

- (4) The softwood generally shall have a moisture content limit not exceeding 15% of the dry weight. The hardwood shall have a moisture content limit of not exceeding 12% of the dry weight and shall have been kiln dried or properly seasoned by other approved means. The whole of the timber for joinery work shall be properly stacked and protected from rain and ground moisture.
- (5) Plywood and Blockboard shall comply with BS 6566 "Plywood" and BS 3444 "Blockboard and laminboard" respectively unless otherwise directed and shall be of the best quality available.
- (6) Chipboard and fibreboard shall comply with BS 5669 "Wood chipboard and methods of test for particle board" and BS 1142 "Fibre building board" unless otherwise described and shall be of the best quality available.
- (7) All adhesives used shall be of the best quality available. Softwood in carpentry work shall be put together with steel nails except where described as framed when it shall be properly jointed and held together with glue and steel screws. Joinery work shall be carefully assembled and properly jointed. All joints shall be glued and screwed or dowelled. Vee joints will not be accepted. All screws appearing on face work shall have the heads let in and be pelleted unless otherwise described. Steel screws shall be used for softwood joinery and brass screws shall be used for hardwood joinery. All joints shall be made in accordance with BS 1186 "Timber for and workmanship in joinery".
- (8) All timber utilized in the construction of roof structures shall be treated with two coats of an approved wood preservative before assembly. Trusses are to be constructed as indicated on the drawings or directed, all necessary ironmongery, nails, straps, etc, are to be allowed for. Unless otherwise indicated timber trusses shall be secured to the wall plates, beams or blockwork as shown on the drawings or as directed.
- (9) Door, window, and frame dimensions are as indicated on the drawings or as directed by the Project Manager. The Contractor shall prepare working drawings showing the detailed construction

of these and samples of sections to be used for approval before fabrication is commenced. Door frame, window frame and window casements shall be in an approved hardwood or other such timber as directed and shall be securely fixed. Doors shall be stored in a weatherproof shed and shall be stacked in a flat position so that they retain their true shape until required for use.

(10) Timber door and window frames shall be built into the structure as work proceeds and fixing shall not be delayed until completion of the works. Door frames shall generally be constructed from an approved softwood, and shall where practical extend the full thickness of the walls to which they are fixed. Where they do not extend the full thickness of the wall they shall not be less than 150mm. The foot of each frame is to be secured to the floor with 12mm diameter galvanized steel dowels 75mm long equally morticed into the frame and concrete floor. Frames shall be secured to the blockwork at the jambs with 25 x 3mm galvanized steel cramps 275 mm long, one end bent and screwed to the back of the frame. The other end ragged and built into the blockwork joints. Where abutting concrete, frames shall be screwed to approved dovetail fixings cast in to the concrete. Frames shall have one layer of approved bituminous felt pinned to the backs before fixing. An approved mastic seal is to be used between the frame and concrete columns or lintels and fairfaced blockwork on external doors and windows where rendering/plastering is not finished against the frame.

(11) External door types and dimensions are as indicated on the drawings or as directed, and unless otherwise indicated shall be flush type, semi-solid cored with external face covered with tongued and grooved "V" jointed vertical 15 x 80mm boarding, and internal face covered with best quality plywood 4mm thick, and with the sides, tops and bottoms lipped and edged with hardwood strips.

(12) Where indicated on the drawings fly screens shall be of fine aluminum insect screening secured to framing by screwed timber battens. Battens to be prepared primed and painted with three coats of approved oil paint.

(13) Architraves, door stops, cover beads, etc, are to be in approved softwood and shall be properly mitred at intersections.

(14) A metal windows, screens and doors shall be obtained from an approved supplier. Such units shall be equipped with all fixing lugs, glazing channels, couplings, hinges, peg strays, handles, mullions, transomes, glass, mastic and putty. Windows, screens and doors shall be stored and fixed in accordance with manufacturer's instructions or as directed and on completion eased and adjusted so that the units are in perfect working order to the satisfaction of the Project Manager.

(15) Door and window furniture and locks, etc. are to be the best quality available and shall be approved by the Project Manager. All locks shall be provided with two keys. On completion of the works all keys shall be handed to the Project Manager securely and clearly labelled. All furniture, hinges and locks are to be securely fixed using the appropriate number and size of screws. All external doors shall be hung on 1½ pairs 100mm stainless steel butts and fitted with a vertical mortice lock, latch and plate, together with anodized aluminum plates and shaped lever handles including spindle. External doors shall be fitted with a vertical mortice lock, latch and place, together with anodized aluminum plates and shaped lever handles, including spindle. Where indicated, windows shall be hung on 1 pair 75mm stainless steel butts or as directed and shall be fitted with all necessary stays, pins, fasteners and hook plates.

(16) All joinery shall be protected from damage during the course of the Works and on completion shall be to the Project Manager's entire satisfaction. Before handing over, the contractor shall see that all doors, drawers, etc, work easily and shall make all necessary adjustments including those needed during the maintenance period.

(17) Ceilings under roof, structures shall consist of panels approximately 600mm x 600mm x 8mm thick of approved termite proof chipboard with chamfered edges. They shall be fixed with galvanized nails to 70 x 70mm battens provided at 600mm centres in both directions.

(18) Louvred ventilation panel shall be fabricated in an approved softwood, painted, and covered with aluminum insect screening and shall be built on to the end gable walls of buildings with ceilings.

(19) Glass in windows shall be 5mm thick. The glass shall be clear flat drawn glass sheets without

any imperfections. For glass louvre windows, louvres shall comprise wooden frames with interconnecting tilting louvre panels on the inside and mesh flyscreen on the outside.

Roofing and Cladding

(1) Galvanized corrugated steel sheet roofing and cladding shall be new sheets of Gauge 22 unless otherwise directed, firmly secured to the purlins or side rails, complete with ridge pieces, stop ends, cappings and flashing.

(2) Fixing to timber purlins shall be with galvanized forge headed screws and suitable resilient washers. Fixing to steel purlins or side rails shall be with galvanized and suitable resilient washers.

(3) All the above shall be in accordance with the manufacturers and Project Manager's instructions and the following British Standard and BS Code of Practice.

(i) BS 3083 Hot dip zinc coated corrugated steel sheets for general purposes".

(ii) CP 143 Part 10 "Galvanized corrugated steel sheet".

Painting and Decorating

(1) The whole of the oil paint, emulsion paint, bituminous paint and the like to be used upon the work shall be of types and manufacture approved by the Project Manager. Priming paint shall be red-lead based.

(2) Knotting shall be best shellac in Methylated Spirits. Stopping shall consist of hard white lead and linseed oil and shall be tinted with not more than 5% genuine red lead. Stain used for fittings shall be approved spirit stain.

(3) All concrete, rendered and plastered surfaces shall be rubbed down to remove all loose particles. No rendering or plastering shall be decorated until it has thoroughly dried out. Defective plaster work and large cracks are to be cut out and made good before painting, and small cracks are to

be carefully stopped.

- (4) Joinery shall be brought to an even silky finish by the use of fine sandpaper. All woodwork for painting shall be carefully knotted, stopped and primed with one coat of priming paint. End grain shall be given two coats.
- (5) Steelwork shall be made absolutely clean and free from all rust, grease, mill-scale, moisture and or other injurious materials. The work of cleaning steel is to be carried out with great thoroughness to the satisfaction of the Project Manager. No paint shall be applied to metal surfaces which are to be embedded in concrete, except where otherwise specified. All galvanized surfaces are to be cleaned of oil, grease and dirt by means of a de-greasing fluid before being primed and painted as specified.
- (6) All materials shall be stored on the site under conditions in accordance with the manufacturer's instructions.
- (7) Paint shall be applied by brushing or spraying in accordance with the manufacturer's instructions and, except where otherwise specified, in accordance with BS 6150 "Code of Practice for painting of buildings". No paint shall be applied to any surface when it is in the slightest degree damp and any paint applied to such damp surfaces shall be scraped off and the surface repainted at the Contractor's expense. The Contractor shall take any precautions necessary to prevent dust and dirt coming into contact with freshly painted surfaces or with surfaces being coated. Particular care shall be taken to maintain a strong paint film on all arrises, boltheads, etc. Second and subsequent coats of paint shall only be applied after the previous coats have dried and hardened and have been well cleaned and rubbed down where necessary. All metal fittings, switches, fastenings, etc. are to be removed before the preparatory processes are commenced and cleaned and refitted on completion of the work.
- (8) The paint and the like shall be kept well stirred and shall not be used when a thick sediment has settled. Any paint or the like which develops a skin on the contents within the tin shall be removed from the Works. Any residue left in a tin shall not under any circumstances be added to the contents of another tin. Brushes stored in thinners shall be thoroughly worked out before re-use.

(9) The final coat of paint shall not be applied until immediately before handing over the building and when handed over shall be free of all imperfections, chips, scratches, etc and all to the satisfaction of the Project Manager.

(10) All hardwood to be oiled shall be given two coats of boiled linseed oil.

(11) All woodwork to be painted shall, after knotting, stopping and priming be painted with one coat of undercoat and 2 coats of gloss finishing coat.

(12) Any damaged areas of paint shall be made good to be full depth of the damaged as the work progresses and properly feathered in to the satisfaction of the Project Manager.

(13) All woodwork to be varnished shall be stopped with stopping to match the color of the wood and shall be rubbed down to give an even silky finish using fine sandpaper. For external woodwork four coats of clean gloss varnish shall be applied and three coats for internal woodwork. Each coat shall be allowed to dry and lightly rubbed down with fine sandpaper before any subsequent coat is applied.

(14) Internal walls and ceilings shall be given one coat priming paint and two coats of approved emulsion paint at least and as many further coats as may be necessary to provide a smooth and evenly coloured surface to the satisfaction of the Project Manager.

(15) Matt painting to plinth plasterwork shall be two coats of black bituminous paint.

(i) Machine Work

(a) General : All tolerances, allowances and gauges for metal fits between plain cylindrical parts shall conform to the requirements of Clause 201 of the Specification or the other approved equivalent standard for the class of fit as shown or otherwise required. Sufficient machining stock shall be allowed on locating pas to ensure true and exact to secure full contact. Journal sliding surfaces shall be

polished, and all surfaces shall be finished with sufficient smoothness and accuracy to ensure proper operation when assembled. Parts entering any machine shall be carefully and accurately located and drilled from templates.

(b) **Finished Surface :** Finished surface shall be indicated on the Contractor's drawings and shall be compliance with specified inspection of the work compared to standard roughness specimen, in accordance with Clause 201 of the Specification.

(c) **Unfinished Surface :** So far as is practicable, all works shall be arranged to obtain proper matching of adjoining unfinished surface, when there is a large discrepancy between adjoining unfinished surface, they shall be chipped and ground smooth, or machined, to secure proper alignment. Unfinished surface shall be true to lines and dimension shown on the Drawings and shall be chipped or ground free of all projections and rough spots. Depressions or holes not affecting the strength or usefulness of the parts may be filled in an approved manner.

(d) **Key and Keyway :** Key and keyway shall conform to the requirements of Clause 201 of the Specification or other approved equivalent standard, unless otherwise specified or required.

(e) **Pin and Pin Hole :** Pin hole shall be bored to gauge, smooth and straight, land at right angle to the axis of member. The boring shall be done after the member is securely fastened in position. Pin shall be of hardened and ground steel positively held in position. Wheel or roller for use in gate shall be made mounted on removable pin and have self-lubricating bushing and brass washer.

(f) **Lubrication :** Before assembly, all bearing surface, journals, and grease and oil grooves shall be carefully cleaned and lubricant. Self-lubricating bearings shall be cleaned with clean rags and greased with an approved lubricant before assembly. Solvent shall not be used on self-lubricating bearings. The specification of all approved lubricants shall be mentioned in operating and maintenance instructions.

(g) **Balancing :** All revolving parts shall be truly balanced both statistically and dynamically so that when running at normal speeds and at any load up to the maximum, there shall be no vibration

due to lack of such balance, and the equipment shall be operated with the least possible amount of noise.

(ii) Miscellaneous Materials

(a) Self-lubricating bearings shall be in accordance with Clause 201 of the Specification. Whenever ASTM must be used, the reference shall be made to ASTM B22, Alloy E, with L-lubricant, other approved equivalent standard.

(b) Rubber gate seals shall be moulded from a high-grade, tread type compound. The basic polymer shall be natural rubber, a co-polymer of butadiene and stems, or a blend or both. The compound shall contain not less than 70 percent by volume of basic polymer, and the remainder shall consist of reinforcing carbon black, zinc-oxide accelerators, antioxidant, vulcanizing agent and/or plasticizers. The compound shall have the following physical properties: -

Tensile strength: 210kg-f/cm² minimum

Ultimate Elongation: 450 % minimum

Durometer Hardness (shore type A): 50 to 70

Specific Gravity: 1.1 to 1.4

Water Absorption (70 C for 48 hours): 5 % at max. by weight

Compression Set (as a percent of total original deflection): 30 % at max.

Tensile Strength after oxygen bomb aging for 38 hours at 70 C: 80 % at max. tensile strength before again.

(iii) Welding shall be in accordance with Clause 710.

(4) Protection, Cleaning and Painting

(i) General

(a) Except otherwise specified in the specification, all painting of the gates and accessories, and the equipment under the Contract shall be performed in accordance with this Clause.

(b) All parts, which will ultimately be buried in concrete, shall be cleaned and protected, before leaving the manufacture's plant, by a cement wash or other approved method. Before being installed they shall be thoroughly descaled and cleaned of all rust and adherent matter. Such cleaning shall not detrimentally affect the strength or final operation and function of the equipment.

(c) All machined parts or bearing surfaces shall be cleaned and protected from corrosion, before leaving the manufacturer's plant, by the application of an approved rust preventive lacquer, or a peelable plastic film. Where the latter is impracticable, such parts shall be heavily covered with high melting point grease. After erection, such parts shall be cleaned with solvent and lapped or polished bright.

(d) All parts, other than machined parts and parts applied with coaltar epoxy resin paint, which will be exposed after erection shall be thoroughly cleaned and given one (1) coat of best quality approved finishing paint before leaving the manufacturer's plants and further one (1) coat of paint of an approved quality and colour after erection and touching up at the site, except such apparatus as panels and instruments which will be finish painted under approved procedures.

(e) Primer shall be applied to surfaces prepared in accordance with the paint manufacturer's instructions. The surface shall be wiped clean immediately prior to applying the paint. The primer and finishing coats of paint shall be applied using the methods and equipment recommended by the manufacturer. The system selected shall have a proven life expectancy of not less than one (1) year in the atmosphere prevailing at the project site.

(f) The final colour chip of all equipment shall be approved by the Project Manager, but the Contractor shall propose a colour scheme for the equipment and shall submit colour chips or paint samples.

(g) A colour chip shall be included with the approved colour schedule, for each type or finish to be applied at the site. All equipment shall be painted as specified herein. The painting shall include

the preparation of the metal surfaces, as well as the supplying of all tools, labour and materials necessary for the entire painting work.

(h) Sufficient paint shall be provided for field painting and touch-up of shop painting by the Contractor.

(i) Paint shall be product of reputable manufactures and its selection shall be approved by the Project Manager.

(ii) **Surface Preparation.**

All oil, paraffin, grease and dirt shall be removed from the surface to be painted, using solvents. Following solvent cleaning, all weld spatter, slag, burrs, loose rust and mill scale and other foreign substances shall be removed by sandblasting or shoot-blasting to near white metal. Special attention shall be given to cleaning of corners and converging angles. If rust forms or surface become contaminated in the interval between cleaning and painting, re-cleaning the same degree shall required. Surfaces not to be painted shall be protected by appropriate and adequate masking during the cleaning and painting of adjacent metal work. Effective means shall be provided for removing all free oil moisture from the air supply lines of blasting equipment. All surface preparations shall be subject to approval by the Project Manager before any paint is applied.

(iii) **Application Procedure**

All paint, when applied, shall provide a satisfactory film and smooth, even surface. Paint shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Paint shall not be applied when the temperature of the metal or of surrounding air is below ten (10) degrees Celsius. Surfaces shall be free from moisture at the time of painting. Painting shall be performed by brushing and/or airless spray. The first coat shall be applied immediately after surface preparation. Each coat shall be allowed to dry or harden thoroughly before the succeeding coat is applied.

(iv) **Surfaces not to be Painted**

(a) Bronze, brass, surfaces of gear teeth, finished ferrous surfaces and surfaces in rolling or sliding

contact after field assembly shall not be painted.

(b) All corrosion-resisting steel surfaces for bearings and machinery parts shall not be painted.

(c) On completion of cleaning, the surfaces shall be coated with an adhesive plastic film to protect the surfaces from minor mechanical damage and corrosion during transportation and storage at the Site. The film shall be stripped off immediately prior to field erection of the equipment.

(v) Paint Schedule

(a) Tar-epoxy and/or epoxy resin paint shall be applied to the exposed surfaces of guide frames except for upper side more than ground line and all gate leaves. Each thickness of painting film shall be approved by Project Manager.

(b) All unfinished surfaces of ferrous metal except those specified above shall be given one (1) primer and four (4) coats of chlorinated rubber paint or equivalent. Total thickness of these coats including primer coat shall be 0.2 to 0.15 millimeter.

(c) Commercial equipment shall be painted in accordance with the manufacturer standard practice.

(d) All finished surfaces of ferrous metal including screw threads that will be exposed during transportation or while a waiting installation shall be cleaned and given a heavy uniform coating of gasoline soluble, rust-preventive compound.

(5) Tests

(i) The Contractor shall submit to the Project Manager for approval, during or immediately following the submission of the Drawing, and instruction procedure describing shop and site tests to be performed for commission and performance testing. The procedures shall define the sequence of the test, the equipment preparation and operation procedures to be followed and the detailed procedure for conducting the tests. These instructions shall be submitted for approval and distributed in the same manner as the Drawings.

(ii) During the construction and after the installation of each item of the equipment, the Contractor shall perform the tests as described in the test procedure instruction to establish the accuracy of the assembly and to prove the adequacy of the materials and workmanship.

(iii) The tests shall be approved by the Project Manager. No part of the work shall be considered acceptable until it has successfully complied with these tests to the satisfaction of the Project Manager.

(iv) The records, data, calculation sheets and photographs shall be submitted to the Project Manager in six (6) copies within four (4) weeks after the test has been conducted.

(6) Spare Parts and Tools

(i) The Contractor shall furnish the following spare parts. Any parts supplied shall be packed or treated in such a manner as to be suitable to be stored under the climate at the Site for a period of not less than two (2) years, and each part shall be clearly marked with its description and purpose on the outside of the package.

(a) One (1) set of gate rubber seal for each size slide gate (undrilled)

(b) Other necessary spare parts recommended by the manufacturer

(ii) Spare parts so provided shall be delivered into such stores as may be nominated by the Employer, and delivery will not be deemed to be complete until the packages have been opened by the Contractor, their contents checked by a Representative of the Employer of the articles re-protected and repacked by the Contractor to the satisfaction of the Employer, or assembled into units at the Employer's option.

(iii) The Contractor shall furnish the tools with box necessary for maintenance purposes. The tools shall be able to disassemble, assemble and adjust equipment and include measuring equipment.

Pile

(1) General

(i) The work described in this Clause use three types of piles: wooden piles, concrete piles and composite pile

(ii) Wooden pile shall be driven for structure foundation and concrete pile and composite pile shall be driven for bridge abutment, syphon and aqueduct foundation as shown on the Drawings or as directed by the Project Manager.

(2) Material

(i) Wooden Pile

(a) Timber for piles shall be well seasoned, sound, bright, free from shakes, large loose or dead knots, waney edges. Diameter of the piles shall be at least as shown in the Drawings. Throughout the whole length, wooden piles shall be made from the same timber, and splicing wooden piles shall be approved by the Project Manager.

(b) The tip of wooden piles shall be sharpened in pyramidal shape and the height of the pyramid shall be made in about 1.5 multiplied by the diameter. Tip protection with steel straps can be made.

(c) The surface of the wooden piles shall be protected by painting asphalt at least three times to the total thickness of 2.5 mm.

(ii) Concrete pile

Concrete piles shall be made of reinforced concrete as shown on the Drawings or as directed by the Project Manager. Concrete and reinforcement steel shall to be used for piles to comply with Part 4 of the Specifications or as directed by the Project Manager.

(iii) Composite pile

Composite pile shall be made of steel pipe in which the reinforced concrete shall be cast as shown on the Drawing.

The steel pipes shall have diameter and thickness as shown on the Drawing. The pipe shall have resistance to the corrosion in accordance with Part 6 of the Specifications concrete and reinforcement to be used for pile shall comply with Part 4 of the Specification.

(3) Driving

(i) Prior to driving piles, the Contractor shall properly set out the driving position for each pile and shall establish position and level marks, which shall be effectively protected until the pertinent works are completed. Stable staging or markers shall be provided in order to obtain correct position and direction of piles.

(ii) Driving equipment shall be of the type generally used in the standard pile driving practice and subject to the approval of the Project Manager. Pile drivers shall be in the best conditions at all times and shall be operated at works. Driving shall always be performed with the use of a cap and cushion.

(iii) Piles shall be driven as accurately as possible in the correct position, true to the line both laterally and longitudinally and to the vertical lines within a tolerance of 10 cm when driven to the final depth. Unless the pile driving equipment is of a type to ensure the works within the specified tolerance at all times, the Contractor shall construct within the tolerance of 5 cm from the true position, temporary guides of sufficient strength to keep piles in their correct positions during pitching and driving. Any piles out of line or plumb to a greater extent than specified above shall be pulled out and redriven or an additional pile shall be driven as directed by the Project Manager at the expense of the Contractor.

(iv) The Contractor shall drive piles continuously until the required depth of penetration per blow have been obtained, which is 1.2mm by a 37.5 kg of hammer freely dropped from 1 m above the head of the pile.

(v) Pile shall be driven as light as possible at the beginning of driving operation with sufficient precautions against shifting in position or inclination and shall be driven in the accurate position and to plumb as required. Any cushion material that has frayed or will cause an eccentric action of the

hammer shall be removed and placed.

(vi) All piles shall be driven to the full length finally determined by the load test or as directed by the Project Manager. If piles are not driven to full length, such piles shall be cut off at the cut-off line and surplus material shall be removed and disposed of or saved as directed by the Project Manager.

(vii) Piles which have not attained the required penetration per blow when the top has been driven to the cut-off elevation shall be spliced and driven to a depth sufficient to develop the required penetration per blow. Spliced parts of the piles shall be reinforced by a steel cylinder of at least 1.5 mm thick and three times longer than the diameter of the piles.

(viii) Piles which have been uplifted after being driven shall be redriven to the required penetration after completion of other driving operation on nearby areas.

(ix) Any piles injured in driving or handling whose structural soundness as a pile is impaired shall be replaced by splicing or otherwise repaired as approved by the Project Manager, at the expense of the Contractor.

(x) In case jetting water and/or drilling pilot holes are necessary for driving piles to the required penetration, the Contractor shall obtain the prior written approval of the Project Manager.

(xi) A complete report of each pile driven shall be submitted to the Project Manager containing the following information:

- (a) Location of pile and ground elevation
- (b) Type and dimension of pile
- (c) Speed and size of hammer
- (d) Speed of operation of hammer
- (e) Number of blows per 30 centimeters for the entire length of pile, and number of blows per 2.5 centimeters for the last 60 centimeters of penetration
- (f) Record of breaks in driving continuity

- (g) Height of hammer
- (h) Piles settlement by each one hammer.

(xii) Vibro-hammer or drop hammer driving will be permitted for wooden pile. The piling method and equipment including the drop hammer to be used for piling are subject to prior approval of the Project Manager. The heads of the piles shall be protected by means of beveling or using cap. The driving heads shall closely fit the top of the wooden pile and shall extend down the sides of the pile at least 10 centimeters.

(4) Pile Driving Test

Prior to the construction of any pile foundation, the Contractor shall carry out, under the direct supervision and to the satisfaction of the Project Manager, a piling test to confirm the carrying capacity of the piles. The method of the testing is subject to the Project Manager's approval prior to such a testing.

APPENDIX A

TABLE OF TOLERANCES

The following are the tolerance within which the Works are to be executed or as directed by the Project Manager:

Earthworks

Top level of embankments after compaction	+100 / -0mm
Sides of embankments over 10m length	+100 / -0mm
Channel or excavation cutting	0 / -30 mm
Horizontal alignment of drains and bunds	
Maximum	100mm

Over 20m length 200mm

Formation level for structure +0 / -ve filled with concrete

Formation level for gabions +0 / -75mm

Land smoothing and leveling ± 70 mm

Canals

Horizontal alignment of canals

Maximum 500mm Over 20m length 100mm

Canal invert level 0 / -20mm

Canal bed width and side slopes -0.

Concrete Structures

Maximum departure of plan position of structure 500mm

Maximum departure in thickness, cross sectional,

or position of columns, beams, walls, footings and the like +10 / -10mm dimensions

Surface tolerance on straightness or departure from specified curve

General surfaces (vertical and horizontal)

Gradual over 10m 25mm

Abrupt 10mm

Reinforcement – maximum departure from required spacing 10mm

Masonry

Masonry over 2m in length +50 / -25 mm

Pitching, Tipped Rock and Gabions

Pitching over 2m in length +75 / -25 mm

Face of gabion / mattress basket +75 / -25 mm

Thickness of tipped rock or filter layer +100 / -0 mm

Additional Limit for Canal Structure

Control level on offtakes and water level control structures +5 / -10 mm

ANNEXES : DRAWINGS (Refer to the attachment)

ANNEX - LOT 1: TAMBALUGO	Upper East/ Bawku Municipal
ANNEX - LOT 2 ADABOYA	Upper East/ Bongo
ANNEX - LOT 3 LAMBOYA	Upper East/ Bawku West
ANNEX - LOT 4: KASIESA	Upper East/ Builsa South
ANNEX - LOT 4: TAMPION	NORTHERN/ SAVALUGU-NANTON
ANNEX - LOT 5 KAKEASE	Northern/ Bole
ANNEX - LOT 5 GOLI	Upper West/ Nadowli
ANNEX - LOT 5 KO GBAFIO	Upper West/ Nandom
ANNEX - LOT 6 TAKPO	Upper West/ Nadowli
ANNEX - LOT 7 BUGUBELLE	Upper West /Sissala West

Section 6: Returnable Bidding Forms / Checklist

This form serves as a checklist for preparation of your Bid. Please complete the Returnable Bidding Forms in accordance with the instructions in the forms and return them as part of your Bid submission. No alteration to format of forms shall be permitted and no substitution shall be accepted.

Before submitting your Bid, please ensure compliance with the Bid Submission instructions of the BDS 22.

Technical Bid:

Have you duly completed all the Returnable Bidding Forms?	
▪ Form A: Bid Submission Form	<input type="checkbox"/>
▪ Form B: Bidder Information Form	<input type="checkbox"/>
▪ Form C: Joint Venture/Consortium/ Association Information Form	<input type="checkbox"/>
▪ Form D: Qualification Form	<input type="checkbox"/>
▪ Form E: Format of Technical Bid/Bill of Quantities	<input type="checkbox"/>
▪ Form G: Form of Bid Security	<input type="checkbox"/>
▪ Format forms for Key personal, Key Equipment and Construction Experiences	<input type="checkbox"/>
Have you provided the required documents to establish compliance with the evaluation criteria in Section 4?	<input type="checkbox"/>

Price Schedule:

▪ Form F: BOQ Form	<input type="checkbox"/>
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Form A: Bid Submission Form

Name of Bidder:	[Insert Name of Bidder]	Date:	Select date
ITB reference:	[Insert ITB Reference Number]		

We, the undersigned, offer to supply the goods and related services required for [Insert Title of goods and services] in accordance with your Invitation to Bid No. [Insert ITB Reference Number] and our Bid. We hereby submit our Bid, which includes this Technical Bid and Price Schedule.

Our attached Price Schedule is for the sum of [Insert amount in words and figures and indicate currency].

We hereby declare that our firm, its affiliates or subsidiaries or employees, including any JV/Consortium /Association members or subcontractors or suppliers for any part of the contract:

- a) is not under procurement prohibition by the United Nations, including but not limited to prohibitions derived from the Compendium of United Nations Security Council Sanctions Lists;
- b) have not been suspended, debarred, sanctioned or otherwise identified as ineligible by any UN Organization or the World Bank Group or any other international Organization;
- c) have no conflict of interest in accordance with Instruction to Bidders Clause 4;
- d) do not employ, or anticipate employing, any person(s) who is, or has been a UN staff member within the last year, if said UN staff member has or had prior professional dealings with our firm in his/her capacity as UN staff member within the last three years of service with the UN (in accordance with UN post-employment restrictions published in ST/SGB/2006/15);
- e) have not declared bankruptcy, are not involved in bankruptcy or receivership proceedings, and there is no judgment or pending legal action against them that could impair their operations in the foreseeable future;
- f) undertake not to engage in proscribed practices, including but not limited to corruption, fraud, coercion, collusion, obstruction, or any other unethical practice, with the UN or any other party, and to conduct business in a manner that averts any financial, operational, reputational or other undue risk to the UN and we embrace the principles of the United Nations Supplier Code of Conduct and adhere to the principles of the United Nations Global Compact.

We declare that all the information and statements made in this Bid are true and we accept that any misinterpretation or misrepresentation contained in this Bid may lead to our disqualification and/or sanctioning by the UNDP.

We offer to supply the goods and related services in conformity with the Bidding documents, including the UNDP General Conditions of Contract and in accordance with the Schedule of Requirements and Technical Specifications.

Our Bid shall be valid and remain binding upon us for the period specified in the Bid Data Sheet.

We understand and recognize that you are not bound to accept any Bid you receive.

I, the undersigned, certify that I am duly authorized by [Insert Name of Bidder] to sign this Bid and bind it should UNDP accept this Bid.

Name: _____

Title: _____

Date: _____

Signature: _____

[Stamp with official stamp of the Bidder]

Form B: Bidder Information Form

Legal name of Bidder	[Complete]
Legal address	[Complete]
Year of registration	[Complete]
Bidder's Authorized Representative Information	Name and Title: [Complete] Telephone numbers: [Complete] Email: [Complete]
Are you a UNGM registered vendor?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, [insert UGNM vendor number]
Are you a UNDP vendor?	<input type="checkbox"/> Yes <input type="checkbox"/> No If yes, [insert UNDP vendor number]
Countries of operation	[Complete]
No. of full-time employees	[Complete]
Quality Assurance Certification (e.g. ISO 9000 or Equivalent) (If yes, provide a Copy of the valid Certificate):	[Complete]
Does your Company hold any accreditation such as ISO 14001 or ISO 14064 or equivalent related to the environment? (If yes, provide a Copy of the valid Certificate):	[Complete]
Does your Company have a written Statement of its Environmental Policy? (If yes, provide a Copy)	[Complete]
Does your organization demonstrates significant commitment to sustainability through some other means, for example internal company policy documents on women empowerment, renewable energies or membership of trade institutions promoting such issues	[Complete]

Is your company a member of the UN Global Compact

[Complete]

Contact person that UNDP may contact for requests for clarifications during Bid evaluation

Name and Title: [Complete]

Telephone numbers: [Complete]

Email: [Complete]

Please attach the following documents:

- Company Profile, which should not exceed fifteen (15) pages, including printed brochures and product catalogues relevant to the services being procured
- Certificate of Incorporation/ Business Registration
- Valid Tax Registration Certificate
- Trade name registration papers, if applicable
- Quality Certificate (e.g., ISO, etc.) and/or other similar certificates, accreditations, awards and citations received by the Bidder, if any
- Environmental Compliance Certificates, Accreditations, Markings/Labels, and other evidences of the Bidder's practices which contributes to the ecological sustainability and reduction of adverse environmental impact (e.g., use of non-toxic substances, recycled raw materials, energy-efficient equipment, reduced carbon emission, etc.), either in its business practices or in the goods it manufactures
- Patent Registration Certificates, if any of technologies submitted in the Bid is patented by the Bidder
- Certification or authorization to act as Agent on behalf of the Manufacturer, or Power of Attorney.
- Export Licenses, if applicable
- Local Government permit to locate and operate in assignment location, if applicable
- Official Letter of Appointment as local representative, if Bidder is submitting a Bid on behalf of an entity located outside the country

Form C: Joint Venture/Consortium/Association Information Form

Name of Bidder:	[Insert Name of Bidder]	Date:	[Select date]
ITB reference:	[Insert ITB Reference Number]		

To be completed and returned with your Bid if the Bid is submitted as a Joint Venture/Consortium/Association.

No	Name of Partner and contact information (address, telephone numbers, fax numbers, e-mail address)	Proposed proportion of responsibilities (in %) and type of goods and/or services to be performed
1	[Complete]	[Complete]
2	[Complete]	[Complete]
3	[Complete]	[Complete]

Name of leading partner (with authority to bind the JV, Consortium, Association during the ITB process and, in the event a Contract is awarded, during contract execution)	[Complete]
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We have attached a copy of the below referenced document signed by every partner, which details the likely legal structure of and the confirmation of joint and severable liability of the members of the said joint venture:

☐ Letter of intent to form a joint venture **OR** ☐ JV/Consortium/Association agreement

We hereby confirm that if the contract is awarded, all parties of the Joint Venture/Consortium/Association shall be jointly and severally liable to UNDP for the fulfillment of the provisions of the Contract.

Name of partner: _____	Name of partner: _____
Signature: _____	Signature: _____
Date: _____	Date: _____
 Name of partner: _____	 Name of partner: _____
 Signature: _____	 Signature: _____
 Date: _____	 Date: _____

Form D: Eligibility and Qualification Form

Name of Bidder:	[Insert Name of Bidder]	Date:	Select date
ITB reference:	[Insert ITB Reference Number]		

If JV/Consortium/Association, to be completed by each partner.

History of Non- Performing Contracts

<input type="checkbox"/> Non-performing contracts did not occur during the last 3 years			
<input type="checkbox"/> Contract(s) not performed in the last 3 years			
Year	Non- performed portion of contract	Contract Identification	Total Contract Amount (current value in US\$)
		Name of Client: Address of Client: Reason(s) for non-performance:	

Litigation History (including pending litigation)

<input type="checkbox"/> No litigation history for the last 3 years			
<input type="checkbox"/> Litigation History as indicated below			
Year of dispute	Amount in dispute (in US\$)	Contract Identification	Total Contract Amount (current value in US\$)
		Name of Client: Address of Client: Matter in dispute: Party who initiated the dispute: Status of dispute: Party awarded if resolved:	

Previous Relevant Experience

Please list only previous similar assignments successfully completed in the last 5 years.

List only those assignments for which the Bidder was legally contracted or sub-contracted by the Client as a company or was one of the Consortium/JV partners. Assignments completed by the Bidder's individual experts working privately or through other firms cannot be claimed as the relevant experience of the Bidder, or that of the Bidder's partners or sub-consultants, but can be claimed by the Experts themselves in their CVs. The Bidder should be prepared to substantiate the claimed experience by presenting copies of relevant documents and references if so requested by UNDP.

Project name & Country of Assignment	Client & Reference Contact Details	Contract Value	Period of activity and status	Types of activities undertaken

Bidders may also attach their own Project Data Sheets with more details for assignments above.

☐ Attached are the Statements of Satisfactory Performance from the Top 3 (three) Clients or more.

Financial Standing

Annual Turnover for the last 3 years	Year 2015	USD
	Year 2016	USD
	Year 2017	USD
Latest Credit Rating (if any), indicate the source		

Financial information (in US\$ equivalent)	Historic information for the last 3 years		
	Year 1 (2015)	Year 2 (2016)	Year 3 (2017)
<i>Information from Balance Sheet</i>			
Total Assets (TA)			
Total Liabilities (TL)			
Current Assets (CA)			
Current Liabilities (CL)			
<i>Information from Income Statement</i>			
Total / Gross Revenue (TR)			
Profits Before Taxes (PBT)			
Net Profit			
Current Ratio			

☐ Attached are copies of the audited financial statements (balance sheets, including all related notes, and income statements) for the years required above complying with the following condition:

- Must reflect the financial situation of the Bidder or party to a JV, and not sister or parent companies;
- Historic financial statements must be audited by a certified public accountant in good standing;
- Historic financial statements must correspond to accounting periods already completed and audited. No statements for partial periods shall be accepted.

Form E: Format of Technical Bid

Name of Bidder:	[Insert Name of Bidder]	Date:	Select date
ITB reference:	[Insert ITB Reference Number]		

The Bidder's Bid should be organized to follow this format of the Technical Bid. Where the bidder is presented with a requirement or asked to use a specific approach, the bidder must not only state its acceptance, but also describe how it intends to comply with the requirements. Where a descriptive response is requested, failure to provide the same will be viewed as non-responsive.

SECTION 1: Bidder's qualification, capacity and expertise

- 1.1 General organizational capability which is likely to affect implementation: management structure, financial stability and project financing capacity, project management controls, extent to which any work would be subcontracted (if so, provide details).
- 1.2 Relevance of specialized knowledge and experience on similar engagements done in the region/country.
- 1.3 Quality assurance procedures and risk mitigation measures.
- 1.4 Organization's commitment to sustainability.

SECTION 2: Scope of Supply, Technical Specifications, and Related Services

This section should demonstrate the Bidder's responsiveness to the specification by identifying the specific components proposed, addressing the requirements, as specified, point by point; providing a detailed description of the essential performance characteristics proposed; and demonstrating how the proposed bid meets or exceeds the requirements/specifications. All important aspects should be addressed in sufficient detail.

- 2.1 Explain whether any work would be subcontracted, to whom, how much percentage of the requirements, the rationale for such, and the roles of the proposed sub-contractors and how everyone will function as a team.
- 2.2 The bid shall also include details of the Bidder's internal technical and quality assurance review mechanisms.
- 2.3 Implementation plan including a Gantt Chart or Project Schedule indicating the detailed sequence of activities that will be undertaken and their corresponding timing.
- 2.4 Demonstrate how you plan to integrate sustainability measures in the execution of the contract.

SECTION 3: Management Structure and Key Personnel

- 3.1 Describe the overall management approach toward planning and implementing the project. Include an organization chart for the management of the project describing the relationship of key positions and

designations. Provide a spreadsheet to show the activities of each personnel and the time allocated for his/her involvement.

- 3.2 Provide CVs for key personnel that will be provided to support the implementation of this project using the format below. CVs should demonstrate qualifications in areas relevant to the scope of goods and/or services.

Format for CV of Proposed Key Personnel

Name of Personnel	[Insert]
Position for this assignment	[Insert]
Nationality	[Insert]
Language proficiency	[Insert]
Education/Qualifications	<i>[Summarize college/university and other specialized education of personnel member, giving names of schools, dates attended, and degrees/qualifications obtained.]</i> [Insert]
Professional certifications	<i>[Provide details of professional certifications relevant to the scope of goods and/or services]</i> ▪ Name of institution: [Insert] ▪ Date of certification: [Insert]
Employment Record/Experience	<i>[List all positions held by personnel (starting with present position, list in reverse order), giving dates, names of employing organization, title of position held and location of employment. For experience in last five years, detail the type of activities performed, degree of responsibilities, location of assignments and any other information or professional experience considered pertinent for this assignment.]</i> [Insert]
References	<i>[Provide names, addresses, phone and email contact information for two (2) references]</i> Reference 1: [Insert] Reference 2: [Insert]

I, the undersigned, certify that to the best of my knowledge and belief, the data provided above correctly describes my qualifications, my experiences, and other relevant information about myself.

Signature of Personnel

Date (Day/Month/Year)

KEY PERSONNEL REQUIREMENTS

Or schedule of personnel to be submitted with the tender.

No.	Key Personnel	No.	Years of Experience (General)	Years of Experience in Proposed Position	Minimum Qualification
1	Contract Manager	1	10	10	Bsc Civil Engineering
2	Irrigation/Dam Engineer	1	7	5	Bsc Civil Engineering
3	Material Engineer	1	7	5	Bsc Civil Engineering
4	Civil/Structural Engineer	1	7	5	Bsc Civil Engineering
5	Electrical/Mechanical Engineer	1	7	5	Bsc Civil Engineering

Tenderers should note the requirement to employ adequate skilled and experienced personnel to perform the work. As a guide it is expected that at least one qualified engineer would be needed to oversee the technical quality of the work together with an experienced on site project manager / contract manager. Additional site supervisors may be necessary depending upon the number of lots to be tendered.

Format for Proposed Key Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed below. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

Equipment Requirements

The following Equipment Requirements have been assessed as those normally required to perform the work.

If the tenderer proposes any alternative plant, it should be nominated together with the reason for not providing the minimum plant requirements.

No.	Equipment and Characteristics	Minimum Requirement
1	Automatic Levelling Instrument	1
2	Excavator 0.5-0.9 m3	2
3	Tipper 6m3	1
4	Concrete Mixers/ Concrete Production Equipment	1
5	Plate Compactor	2

6	Butt welding machine for HDPE pipe connection	3
7	40 - ton Crane	1
8	Pumping and Dewatering Equipment	1
9	15 ton Crane Truck	1

Construction Experiences

Specific Construction Experience in Key Activities

Bidder's Legal Name:

Date:

JV/Consortium Member's Legal Name:

Bidding No.:

Subcontractor's Legal Name:

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	Information		
Contract Identification			
Award date Completion date			
Role in Contract	<input type="checkbox"/> Contractor	<input type="checkbox"/> Management Contractor	<input type="checkbox"/> Subcontractor
Total contract amount	US\$		
If partner in a JV or subcontractor, specify participation of total contract amount			

	Information
Employer's Name:	
Address:	
Telephone/fax number:	
E-mail:	
Description of the key activities in accordance with the Works of Statement section 5	

Similar Construction Experience

Applicant's/Joint Venture/Consortium Partner's Legal Name:

Date:

JV/Consortium Party Name:

Page ... of ... pages

Similar Contract No.	Information
Contract Identification	Name:
	Contract no:
Award date	
Start date	
Completion date	

Similar Contract No.	Information		
Role in Contract <i>[check the appropriate box]</i>	Contractor <input type="checkbox"/>	Management Contractor <input type="checkbox"/>	Subcontractor <input type="checkbox"/>
Total Contract Amount	US\$		
If partner in a JV/Consortium, or subcontractor, specify participation in total contract amount			
Employer's Name ² :			
Address:	Telephone		
Telephone/fax number			
E-mail:			
Description of the similarity in accordance with section 5			
1. Amount			
2. Physical size			
3. Complexity			
4. Methods/Technology			
5. Other Characteristics			

General Construction Experience

Applicant's Legal Name:

Date:

Applicant JV/Consortium Party Legal Name:

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Starting Month / Year	Ending Month / Year	Contract Identification	Role of Applicant
		<p>Contract name:</p> <p>Brief Description of the Works performed by the Applicant:</p> <p>Amount of contract: US\$</p> <p>Name of institution:</p> <p>Address:</p> <p>Contact person:</p> <p><i>Tel:</i></p> <p><i>Fax:</i></p> <p><i>Email:</i></p>	

¹ UND reserves the right to contact this person or any other person for reference check. It is in the best interest of the Applicant to seek that the contact person provided in this form responds within a maximum of 3 days when contacted by Employer. A non-response from the reference could be treated as a poor reference.

FORM F: Price Schedule Form

Name of Bidder:	[Insert Name of Bidder]	Date:	Select date
ITB reference:			

The Price Schedule **MUST** be prepared using the attached BoQ per lot (Annexes)

Currency of the Bid: USD

ATTENTION: BOQ ATTACHED SEPARATELY

The BOQs should be downloaded and filled in properly and submit.

The BOQs are in lots (1-7)

Name of Bidder: _____
Authorised signature: _____
Name of authorised signatory: _____
Functional Title: _____

FORM G: Form of Bid Security or Bid Bond

Bid Security or Bid Bond must be issued using the official letterhead of the Issuing Bank or Insurance Company.

Except for indicated fields, no changes may be made on this template.

To: UNDP
[Insert contact information as provided in Data Sheet]

WHEREAS [Name and address of Bidder] (hereinafter called "the Bidder") has submitted a Bid to UNDP dated [Click here to enter a date](#) to execute goods and/or services [Insert Title of Goods and/or Services] (hereinafter called "the Bid"):

AND WHEREAS it has been stipulated by you that the Bidder shall furnish you with a Bank Guarantee or Bid Bond by a recognized bank or Insurance Company for the sum specified therein (2% of the Contract Sum) as security if the Bidder:

- a) Fails to sign the Contract after UNDP has awarded it;
- b) Withdraws its Bid after the date of the opening of the Bids;
- c) Fails to comply with UNDP's variation of requirement, as per ITB instructions; or
- d) Fails to furnish Performance Security, insurances, or other documents that UNDP may require as a condition to rendering the contract effective.

AND WHEREAS we have agreed to give the Bidder such Bank Guarantee or Bid Bond:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Bidder, up to a total of [amount of guarantee] [in words and numbers], such sum being payable in the types and proportions of currencies in which the Price Bid is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of [amount of guarantee as aforesaid] without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

This guarantee shall be valid up to 30 days after the final date of validity of bids.

SIGNATURE AND SEAL OF THE GUARANTOR BANK / INSURANCE

Signature: _____

Name: _____

Title: _____

Date: _____

Name of Bank: _____

Address: _____

[Stamp with official stamp of the Bank]