



Pavua Hydropower Project

Tender Documents: Site Investigation

September 2016



BUILDING A BETTER WORLD

Client: eleQtra Ltd on behalf of InfraCo Africa Ltd.

Project: Pavua Hydropower Project

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1. INSTRUCTIONS TO TENDERERS

1.1 Definitions

The following definitions apply to this Request for Proposal (RFP):

- The **Employer** shall be eleQtra Ltd, Eastgate House, 16-19 Eastcastle St, London W1W 8DA. The local contact in Mozambique shall be Lauren Thomas, telephone: +258 823637639, lauren.thomas@eleqtra.com. eleQtra is developing the Pavua Hydropower Project on behalf of InfraCo Africa Ltd.
- The **Employer's Local Partner** in Mozambique for the Project shall be Tora Holding S.A who are based in Maputo. The contact shall be Rita Faria, telephone: +258 84 3107699.
- The **Engineer** shall be MWH UK Ltd, Buckingham Court, Kingsmead Business Park, Frederick Place, High Wycombe, Buckinghamshire, United Kingdom, HP11 1JU. The contact shall be Giles Hird, telephone: +44 1494 561905, giles.hird@mwhglobal.com.
- The **Project** will be the development of a hydroelectric dam on the Pungwe River in Sofala, Mozambique, with the estimated capacity of 120MW.
- The **Tender Total** shall be the total sum submitted by the Tenderer for completing the works as described within RFP.

1.2 Introduction

The Client will select a firm among in accordance with the method of selection specified in the RFP.

- 1.2.1 Tenderers are invited to submit a Proposal for site investigations as outlined in this RFP. The proposal will be the basis for contract negotiations and ultimately for a signed contract with the selected firm.
- 1.2.2 The Client and/or the local partner of the Project, Tora Holding S.A., will assist the Contractor in obtaining licenses and permits needed to carry out the works, where required.
- 1.2.3 eleQtra's policy requires that Tenderers provide professional, objective, and impartial advice and at all times hold the Project's interests paramount, without any consideration for future work, and strictly avoid conflicts with other assignments or their own corporate interests. Tenderers shall not be hired for any assignment that would be in conflict with their prior or current obligations to other clients, or that may place them in a position of not being able to carry out the assignment in the best interest of the Project.
- 1.2.4 It is eleQtra's policy to require that Tenderers under this project observe the highest standard of ethics during the bidding process and execution of the contract. In pursuance of this policy, eleQtra:
 - (a) defines, for the purposes of this provision, the terms set forth below as follows:
 - (i) "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of any official in the selection process or in contract execution; and
 - (ii) "fraudulent practice" means a misrepresentation of facts in order to influence a selection process or the execution of a contract to the detriment of the Project, and includes collusive practices among Tenderers (prior to or after submission of proposals) designed to establish prices at artificial, noncompetitive levels and to deprive the Project of the benefits of free and open competition.
 - (b) will reject a Proposal for award if it determines that the firm recommended for award has engaged in corrupt or fraudulent activities in competing for the Contract in question;
 - (c) will terminate the contract if it at any time determines that corrupt or fraudulent practices were engaged in by the bidders during the bidding process or the execution of the Contract;
 - (d) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that the firm has engaged in corrupt or

- fraudulent practices in competing for, or in executing, the Contract; and
- (e) will terminate the contract if it at any time determines that information provided in the proposal contains false or misleading information.
- 1.2.5 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by any lender from which the Project might source funding.
- 1.2.6 Tenderers shall furnish information as described in the Financial Proposal submission form on commissions and gratuities, if any, paid or to be paid to agents relating to this proposal, and to execute the work if the firm is awarded the Contract.

These instructions will not form part of any ensuing Contract.

Failure to comply with any of these instructions may lead to tenders being rejected.

1.3 Conditions of Contract

The Conditions of Contract shall comprise the FIDIC Red Book 1999 with such amendments and additions as may be agreed by the parties. Proposed amendments and additions are set out in Sections 2 and 3 of this RFP. Tenderers and the Employer may each propose additional or alternative terms during negotiations.

The Employer and the Engineer, for purposes of this RFP, will collectively be deemed the "Client".

This document and all annexes and attachments will be referred to as the "RFP" or the "Tender Documents". All bidding firms are referred to as the "Tenderer". Submissions to be provided by a Tenderer in response to this RFP shall be deemed the "Proposal" or "Proposals".

1.4 Clarification and Amendment of RFP Documents

- 1.4.1 Tenderers may request a clarification of any of the RFP documents up to 5 days before the proposal submission date. Any request for clarification must be sent in writing by electronic mail to Giles Hird at giles.hird@mwhglobal.com. The Client shall not be held liable for a failure to respond to such requests.
- 1.4.2 At any time before the submission of proposals, the Client may, for any reason, whether at its own initiative or in response to a clarification requested by an invited firm, amend the RFP. Any amendment shall be issued in writing by electronic mail through addenda. Addenda shall be sent by electronic mail to all invited Tenderers and will be binding on them. eleQtra may at its discretion extend the deadline for the submission of proposals.
- 1.4.3 None of eleQtra or their servants, agents or advisers:
- Make any representation or warranties (express or implied) as to the adequacy, accuracy, reasonableness or completeness of the information contained in this RFP or otherwise communicated to bidders as part of this competitive bidding exercise;
 - Accept any responsibility in relation to the adequacy, accuracy, reasonableness or completeness of such information or any part of it; and
 - Shall be liable for any loss or damage (other than in respect of fraud or fraudulent misrepresentation) arising as a result of reliance by a bidder on such information.

1.5 Site Visit

- 1.5.1 Due to its remote location and the need for the Tenderers to plan access arrangements into the site, all Tenderers are encouraged to attend a formal site visit to inspect the site such that the site conditions and access arrangements are clearly understood and to ensure the appropriate plant / equipment is proposed in their tender (the "Site Visit").
- 1.5.2 The date of the Site Visit will be **Thursday 6th October 2016**. Tenderers are required to confirm their intent to attend the Site Visit as part of their acknowledgment of receipt of the Tender Document. More details relating to the Site Visit will follow in advance.

1.6 Preparation of Proposal

- 1.6.1 Tenderers are requested to submit a proposal written in English.
- 1.6.2 Any expenditure, work or effort undertaken by a Tenderer in respect of this procurement

process is a matter solely for the commercial judgment of the Tenderer and their sole responsibility. The Client will not reimburse any costs incurred by Tenderer in connection with the preparation and submission of their Proposal.

A) Technical Proposal

1.6.3 In preparing the Proposal, Tenderers are expected to examine the documents constituting this RFP in detail. Material deficiencies in providing the information requested may result in rejection of a Proposal.

1.6.4 While preparing the Proposal, Tenderers must give particular attention to the following:

- (i) This is a Quality-Based Selection assignment.
- (ii) It is desirable that the majority of the key professional staff proposed be permanent employees of the firm or has an extended and stable working relationship with it.
- (iii) Alternative professional staff shall not be proposed, and only one curriculum vitae (CV) may be submitted for each position.
- (iv) Reports to be issued by the Tenderer as part of this assignment must be in English.

1.6.5 The Proposal shall provide the following information:

- Programme
- Track record and experience of similar investigations for major dams in southern Africa
- CVs of key personnel
- Method Statements
- Outline description of geophysical and borehole televiwer investigations
- Health & Safety Information
- Evidence of Insurances

i) Programme

The Proposal shall be accompanied by a preliminary programme which shall show the periods required and the sequence in which the Tenderer proposes to undertake the various parts of the investigation and the dates of the principal operations. Tenderers are free to choose how the information is presented, but details must include an easy to understand bar chart programme.

ii) Track Record

The Tenderer shall provide details of geotechnical investigations carried out for similar purposes and geological conditions. In particular, the Tenderer should provide details of all investigations performed in connection with large dams and major hydraulic structures and performed to International Standards.

iii) CVs of key personnel

The Tenderer shall provide CVs of their key personnel, including Site Manager, Engineering Geologist, Geophysicist, Drilling foreman and other engineering staff to be used in connection with the Contract.

iv) Method Statements

The Tenderer shall be accompanied by preliminary Method Statements describing the Tenderer's proposed methods, including temporary works and safety provision. The preliminary Method Statements are for Proposal evaluation purposes and will not form part of any ensuing Contract. Detailed site specific method statements and associated risk assessments will be required to be submitted by the Contractor prior to mobilisation to site.

v) Outline description of geophysical investigations

The Tenderer shall provide details of his proposed geophysical investigation, equipment, methods and specialist personnel.

The inclusion of an acoustic televiwer survey of the boreholes is optional at this stage. Tenderers are required to submit a price for carrying out these works, and also provide details of his proposed borehole acoustic televiwer equipment, personnel and typical outputs from previous studies to illustrate the performance and limitations of the technique. The requirement for completing an acoustic televiwer survey shall be confirmed in writing to the Contractor following award.

vi) Health & Safety Information

The Tenderer shall submit the following details relating to Health and Safety:

(a) completed "Health & Safety Questionnaire", which, inter alia, should demonstrate:

- that Health and Safety has been adequately provided for in their Proposal;
- a clear specification for the resources allocated to control and manage the major Health and Safety risks, including those associated with working within a remote part of central Mozambique.

(b) a copy of their Health and Safety policies;

(c) evidence of competence to carry out the construction work to the requirements of Health and Safety legislation.

This information is for tender evaluation purposes and will not form part of any ensuing contract.

Tenders shall be submitted by completion of the documents listed below, and the preparation of the additional information described in Clause 1.2.9 below.

Section 3	Form of Tender Form of Tender – Appendix Part 2
Section 5	Bill of Quantities
Section 6	Tenderer's Data List of Personnel List of Laboratories Health and Safety Questionnaire

B) Financial Proposal

- 1.6.6 In preparing the Financial Proposal, Tenderers are expected to take into account the requirements and conditions outlined in the RFP documents. It should list all costs associated with the assignment, including (a) remuneration for staff (foreign and local, in the field and at headquarters), and (b) reimbursable expenses such as subsistence (per diem, housing), transportation (international and local, for mobilization and demobilization), services and equipment (vehicles, office equipment, furniture, and supplies), office rent, insurance, printing of documents, surveys, and training, if it is a component of the assignment. If appropriate, these costs should be broken down by activity and, if appropriate, into foreign and local expenditures. Further information on pricing is included in the Bill of Quantities.
- 1.6.7 The Financial Proposal should clearly estimate, as a separate amount, the local taxes (including social security), duties, fees, levies, and other charges imposed under the applicable law, on the contractors, the sub-contractors, and their personnel (other than nationals or permanent residents of Mozambique), unless the RFP specifies otherwise.
- 1.6.8 Tenderers may express the price of their works in US Dollars.
- 1.6.9 The Bill of Quantities in Part 5 of this Tender Document is to be completed by the Tenderer according to the rules and guidelines of the method of measurement included in Part 5 of this Tender Document.
- 1.6.10 Commissions and gratuities, if any, paid or to be paid by the Tenderer and related to the assignment will be listed in the Financial Proposal submission form.

- 1.6.11 The Tenderer should indicate how long the proposals must remain valid after the submission date (minimum 60 days). During this period, the Tenderer is expected to keep available the professional staff proposed for the assignment. eleQtra will make its best effort to complete negotiations within this period. If eleQtra wishes to extend the validity period of the proposals, the Tenderers who do not agree have the right not to extend the validity of their proposals.
- 1.6.12 Following receipt of tenders, they will be arithmetically checked. Should there be an error in the Bill of Quantities, the error shall be corrected as follows, and a revised Tender Total calculated:
- If the error is in extending unit prices to the "amount" column, then the unit price or rate shall govern and the extension product of rate and quantity into the "amount" column (the Prices) shall be corrected accordingly,
 - If the error is in transcribing sums or prices, or in summing amount columns, then the transcription or summation error shall be corrected accordingly.

Tenderers will be notified of any errors and amendments and asked either to confirm the revised Tender Total or to withdraw their Proposal.

1.7 Submission, Receipt, and Opening of Proposals

- 1.7.1 An authorized representative of the firm must initial all pages of the Proposal. The representative's authorization must be confirmed by a written power of attorney accompanying the Proposal.
- 1.7.2 The completed Technical and Financial Proposals must be delivered at the submission email addresses on or before **12.00 GMT (MOZ -2) Friday 17th October 2016**. Any Proposal received after the closing time for submission of proposals shall be disqualified. Submissions must be addressed to the Engineer with copy to the Employer at the email addresses in 1.1.

1.8 Proposals Evaluation

i) General

- 1.8.1 Any effort by the firm to influence eleQtra in the proposal evaluation, proposal comparison or contract award decisions may result in the rejection of the Tenderer's Proposal.

ii) Evaluation of Technical Proposal

- 1.8.2 The evaluation committee evaluates the proposals on the basis of their responsiveness to the requirement of this RFP, ability to mobilize sufficient resources to undertake the investigation, quality of proposed professional staff and price. A proposal shall be rejected at this stage if it does not respond to important aspects of this RFP.
- 1.8.3 The firm submitting the proposal that is evaluated most highly on the criteria in 1.5.2 and will be invited to negotiate its proposal and the Contract on the basis of the Technical Proposal and the Financial Proposal submitted in accordance with the instructions given in the RFP.

iii) Negotiations

- 1.8.4 Negotiations, if necessary, will be held with the aim to reach agreement on all points and sign a contract.
- 1.8.5 Negotiations, if necessary, will include a discussion of the Technical Proposal, the proposed methodology (work plan), staffing and any suggestions made by the firm to improve the Terms of Reference. eleQtra and firm will then work out final Terms of Reference, staffing, and bar charts indicating activities, staff, periods in the field and in the home office, staff-months, logistics, and reporting. The agreed work plan and final Terms of Reference will then be incorporated in the "Description of Services" and form part of the contract, (hereby referred to as the "Contract"). Special attention will be paid to getting the most the firm can offer within the available budget and to clearly defining the inputs required from eleQtra to ensure satisfactory implementation of the assignment.

- 1.8.6 The financial negotiations will include a clarification (if any) of the firm's tax liability in Mozambique, and the manner in which it will be reflected in the contract; and will reflect the agreed technical modifications in the cost of the works.
- 1.8.7 Having selected the firm on the basis of, among other things, an evaluation of proposed key professional staff, eleQtra expects to negotiate a Contract on the basis of the experts named in the proposal. Before contract negotiations, eleQtra will require assurances that the experts will be actually available. eleQtra will not consider substitutions during contract negotiations unless both parties agree that undue delay in the selection process makes such substitution unavoidable or that such changes are critical to meet the objectives of the assignment. If this is not the case and if it is established that key staff were offered in the proposal without confirming their availability, the firm may be disqualified.
- 1.8.8 The negotiations will conclude with a review of the draft form of the contract. To complete negotiations eleQtra and the firm will initial and execute the agreed Contract.

1.9 Award of Contract

- 1.9.1 The Contract will be awarded following negotiations. After negotiations are completed, eleQtra will promptly notify other contractors on the shortlist that they were unsuccessful.
- 1.9.2 The firm is expected to commence the assignment on the date and at the location specified in the RFP.

1.10 Confidentiality

- 1.10.1 Information relating to evaluation of proposals and recommendations concerning awards shall not be disclosed to the Tenderers who submitted the proposals or to other persons not officially concerned with the process, until the winning firm has been notified that it has been awarded the Contract.
- 1.10.2 The Proposals, appendices and information submitted with the Proposals are the property of eleQtra.

1.11 Disclosure

- 1.11.1 Tenderers must disclose in their Proposal any circumstances, including personal, financial and business activities that will, or might, give rise to a conflict of interest by taking part in this competitive bidding exercise or if awarded the contract. This also applies to any sub-contractors to be proposed by the Tenderer. Where Tenderers identify any potential conflicts they should state how they intend to avoid such conflicts. eleQtra (at their absolute discretion) reserve the right to reject any Proposal which, in eleQtra' opinion, gives rise or could potentially give rise to a conflict of interest.
- 1.11.2 The Tenderer must provide a complete disclosure of any:
- a) Relationship between the Tenderer with the Government of Mozambique;
 - b) Ongoing litigation with the Tenderer.
 - c) Cases where the Tenderer is, or has reason to believe that it may have been, or is subject to, any proceedings that may be listed by the World Bank in its "Listing of Ineligible Firms" or "Listing of Firms, Letters of Reprimand" posted at <http://www.worldbank.org> or any similar list maintained by any other donor of development funding; or on the 'consolidated list of financial sanctions targets in the UK' published by HM Treasury in the UK; or on the Specially Designated Nationals and Blocked Persons List maintained and published on the U.S. Office of Foreign Assets Control website (the "Lists").

1.12 Insurance

- 1.12.1 It is a legal requirement that the Contractor hold (Compulsory) Liability Insurance of £5 million as a minimum. Additional Insurances, such as Public Liability Insurance, Professional Indemnity Insurance and/or Product Liability Insurance, may be required and included in the contract if the Tenderer reaches the contracting stage.

2. CONDITIONS OF CONTRACT

The Conditions of Contract comprise the 'General Conditions', which form part of the 'Conditions of Contract for Construction' First Edition 1999 published by the Federation Internationale des Ingenieurs-Conseils (FIDIC), and the following 'Particular Conditions', which include amendments and additions to such General Conditions.

2.2 Particular Conditions

1. GENERAL PROVISIONS

1.1.3 Dates, Tests, Periods and Completion

Delete Sub-Clause 1.1.3.2 and replace with the following:

"Commencement Date" means the date of execution of the Contract.

The following Sub-Clause is added:

1.1.3.10 – "Wet Season" means the period of the year that is generally considered to be the wet season in the area of Mozambique where the Site is located, on or after 15th November of each year and on which rainfall of at least 5 mm/day is recorded in respect of that day and the following three consecutive days.

1.1.5 Works and Goods

The following Sub-Clauses are added:

1.1.5.9 – "Report" means the Draft Factual Report and/or the Final Factual Report.

1.1.5.10 – "Draft Factual Report" has the meaning given to it in the Specification.

1.1.5.11 – "Final Factual Report" has the meaning given to it in the Specification.

1.1.5.12 – "Investigation" means the Site Operations together with the Report preparation and submission.

1.1.5.13 – "Site Operations" means all Site-based activities including but not limited to: drilling; in-situ testing; trial pitting, logging and sampling; core logging, sub-sampling and sample preparation for transport, reinstatement/backfilling and installation of groundwater monitoring, surface geophysics, geological mapping and associated surveying.

1.9 Delayed Drawings or Instructions

Delete sub-paragraph (b) of Sub-Clause 1.9.

The following Sub-Clause is added:

1.15 Anti-Corruption Commitments

1.15.1 The Contractor undertakes that, in relation to the Contract, it shall:

- (a) act honestly at all times;
- (b) not offer, give, demand or accept (or attempt the same), directly or indirectly, any bribe or other improper benefit or advantage, including any "facilitation" payments (i.e. payments to secure or expedite the performance of routine administrative functions) or "kickbacks" (i.e. payments made in return for a business favour or other advantage) of any kind;
- (c) not make or receive (or attempt the same), directly or indirectly, any payment except to the extent that such payment is legitimate compensation for legitimate work, materials, equipment, or services;
- (d) not provide any written or oral information which it knows to be false, inaccurate or misleading, and will take all reasonable steps to ensure that all information provided is accurate and correct;
- (e) comply with all applicable laws relating to bribery, extortion, fraud, theft, deception, competition, collusion, cartels, abuse of power, embezzlement, trading in influence, money-laundering, terrorist financing and economic crime and sanction laws of the United Kingdom, the United

States and the Project Country, including the UK Bribery Act, the US Foreign Corrupt Practices Act, and analogous laws in the Country;

- (f) comply with any additional anti-corruption policies and procedures that may be required by the Employer, and in such event, the Employer shall provide the Contractor with a copy of such additional policies and procedures; and
- (g) have and maintain in place throughout the term of this Agreement its own policies and procedures, no less stringent than those set out in this Sub-Clause, including adequate procedures under the UK Bribery Act, to ensure compliance with sub-paragraph 1.15.1 of this Sub-Clause, and will enforce them where appropriate.

1.15.2 The Contractor shall not deliberately, knowingly or recklessly act under the Contract in any way that could provide an improper benefit or advantage to any individual or organisation.

1.15.3 The Contractor shall disclose to the Employer, as soon as it becomes aware:

- (a) any family, business or financial connection between (i) it, any of its owners, officers, directors, employees, subsidiary companies, agents, consultants, representatives or sub-contractors or their respective family members and (ii) any public or government official relevant to the Works or the Contract, or any owner, officer, director or employee of any other organisation relevant to the Works or the Contract;
- (b) if it or any of its owners, officers, directors, employees, subsidiary companies, agent, consultants, representatives or sub-contractors or any of their respective family members do become a candidate or are elected for any political office in any jurisdiction in which the Works will or may be performed (in which case, the Employer shall have the right to terminate this Agreement under Sub-Clause 15.2); and
- (c) any breach or potential breach of any provision of this Sub-Clause by it or any of its owners, officers, directors, employees, subsidiary companies, agents, representatives, consultants or sub-contractors in relation to the Services.

1.15.4 The Contractor represents and warrants that neither it nor any of its owners, officers, directors, employees, subsidiary companies, agents, consultants, representatives or sub-contractors:

- (a) has breached any of the obligations listed in sub-paragraphs 1.15.1, 1.15.2 and 1.15.3 of this Sub-Clause in connection with or relating to the entry into, execution of or performance of the Contract, the Works or any other work to be performed for the Employer;
- (b) is currently a candidate for any political office in any jurisdiction in which the Works will or may be performed;
- (c) has, prior to and as of the Commencement Date: (i) committed an offence, or had any investigation or prosecution commenced against it for any alleged commission of an offence under (x) the Bribery Act 2010 of the United Kingdom, the Foreign Corrupt Practices Act of the United States or any similar legislation in any jurisdiction concerning the Contractor or (y) applicable law relating to fraud or other corrupt acts; (ii) committed an act or failed to take action that would otherwise constitute an offence under the laws referred to in item (i) of this sub-paragraph 1.15.4(c) had such action or failure to act occurred in the United Kingdom or the United States, as applicable; or (iii) been listed by any international institution, government department or agency as being debarred, suspended, proposed for suspension or debarment, or otherwise ineligible for participation in government procurement programmes or contracts.

1.15.5 The Contractor shall, in relation to the Works:

- (a) ensure that its owners, officers, directors, employees, subsidiary companies, agents, consultants, representatives, and sub-contractors comply with the commitments set forth in sub-paragraphs 1.15.1, 1.15.2, 1.15.3, 1.15.5, and 1.15.6 of this Sub-Clause; and
- (b) take reasonable steps to ensure that other organisations with which it contracts (including joint venture partners, contractors, consultants, sub-contractors, suppliers, and agents) provide it with equivalent written commitments to those contained in sub-paragraphs 1.15.1, 1.15.2, 1.15.3, and 1.15.5 of this Sub-Clause, and comply with these commitments.

1.15.6 The Contractor shall:

- (a) at the request of, and in the form requested by the Employer, certify from time to time that (i) it is in compliance with this Clause; and (ii) to the best of its knowledge and belief, no other person, including its owners, directors, officers, subsidiary companies, employees, consultants, agents, sub-contractors and representatives, has breached any of the obligations listed in sub-paragraphs 1.15.1, 1.15.2, and 1.15.3 of this Sub-Clause in connection with or relating to the Contract, the Works or any other work performed for the Employer; and
- (b) cooperate (and cause its owners, officers, directors, employees, subsidiary companies, agents, consultants, representatives, and sub-contractors to cooperate) in good faith with the Employer and/or its representatives in determining whether any violation of this Sub-Clause has occurred.

1.15.7 The Contractor agrees that any breach of this Sub-Clause shall entitle the Employer to terminate the Contract under sub-paragraph (h) of Sub-Clause 15.2.

2. THE EMPLOYER

2.4 Employer's Financial Arrangements

Delete Sub-Clause 2.4.

4. THE CONTRACTOR

Delete Sub-Clause 4.12 (b)

The following Sub-Clause is added:

4.12.1 Contamination

4.12.1.1 - Notwithstanding any requirements within Sub-Clause 4.12 If during the Investigation the Contractor encounters contamination or hazardous conditions which could not in his reasonable opinion have been foreseen he shall immediately:

- (a) inform the Engineer;
- (b) take whatever steps he considers necessary to protect his staff and other persons and property and to secure the Site so far as is possible or safe;
- (c) notify any local or other authority or other competent regulatory/statutory body having jurisdiction within the Country of any potential risk to public health or safety; and
- (d) notify the Engineer of the Contractor's assessment of the nature of the contamination or hazard.

If as a result of encountering such conditions it is in the Contractor's reasonable opinion necessary whether for reasons of safety or protection of persons and property or otherwise to suspend the Site Operations or part of the Site Operations he shall do so forthwith taking whatever steps may be necessary to secure the Site and exclude access from unauthorised persons.

4.12.1.2 – If on considering the circumstances the Engineer considers that the Investigation is more hazardous than could have been foreseen he shall:

- (a) after discussion with the Contractor and any local or other authority confirm or amend the steps taken by the Contractor under Sub-Clause 4.12.1.1(b); and
- (b) confirm or amend any suspension of the Site Operations.

4.12.1.3 – The whole of any suspension confirmed by the Engineer shall be deemed a suspension ordered by the Engineer in accordance with Sub-Clauses 8.8 to 8.11.

4.12.1.4 – Any delay incurred by the Contractor as a result of the conditions encountered shall be considered by the Engineer under the provisions of Clause 8.

6. STAFF AND LABOUR

6.4 Labour Laws

Insert at the end of Sub-Clause 6.4:

'The Contractor shall not employ "forced or compulsory labour" in any form. "Forced or compulsory labour" consists of all work or services not voluntarily performed, that is extracted from an individual under threat of force or penalty. The Contractor shall not employ any person under the age of 18 to perform any part of the Works.'

6.8 – Contractor's Superintendence

Insert at the end of Sub-Clause 6.8:

The Contractor shall maintain at least one senior representative on Site that shall be fluent in the English and Portuguese language at all times.

The following Sub-Clauses are added:

6.12 – Services of a Specialist

'In addition to the superintendence in accordance with Sub-Clause 6.8, the Contractor shall make available specialist staff as required in the Specification or by the Engineer.'

6.13 - Foreign Staff and Labour

'The Contractor may engage any personnel domiciled abroad who are necessary for the execution of the Works. The Contractor must ensure that these personnel are provided with the required residence visas and work permits. The Contractor shall be responsible for the return to the place where they were recruited or to their domicile of imported Contractor's Personnel. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.'

6.14 - Alcoholic Liquor or Drugs

'The Contractor shall not import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal by Contractor's Personnel.'

6.15 - Arms and Ammunition

'The Contractor shall not give, barter or otherwise dispose of to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.'

7. PLANT, MATERIALS AND WORKMANSHIP

The following sub-clause is added:

7.9 – Continuation required by conditions

- (a) If during the execution of Site Operations the Contractor encounters or expects to encounter ground or geological conditions which in his opinion make it necessary for the effectiveness of the Investigation or for the adequacy of the Report to vary the Investigation or to continue the Site Operations to a greater extent than specified in the Contract he shall advise the Engineer immediately to request instructions. In the event that the Engineer or his representative are not available to issue instructions in such a way that neither the Engineer nor his representative can be contacted within 2 hours by any of the available methods (e.g. return journey, telephone, etc.) the Contractor may continue such operations or change the mode of operation at his own discretion provided the cost of such changes does not exceed the lesser value of 1% of the Contract Value or US\$500.
- (b) In the event of the Investigation being continued in accordance with Sub-Clause 7.9(a) the Contractor shall simultaneously pursue contact with the Engineer or his representative.'

8. COMMENCEMENT, DELAYS AND SUSPENSION

8.1 Commencement of Works

Delete the first paragraph of Sub-Clause 8.1.

'The Time for Completion of the works shall be measured from the Commencement Date but this shall not affect delivery against the key project milestones defined in the Tender. Mobilisation of the

Contractor's staff and equipment shall be sufficient to allow drilling and in-situ testing to the satisfaction of the Engineer to start within 3 weeks of the Commencement Date or as detailed in the Specification for particular items. The Contractor shall then proceed with the Works with due expedition and without delay.

If the Contractor has not started drilling operations including all in situ testing within 28 calendar days of the Commencement Date, the Employer has the right to terminate the Contract and to call on the Advance Payment Guarantee.'

8.3 Programme

Delete first paragraph of Sub-Clause 8.3 and replace with:

'The Contractor shall submit a detailed time programme with his Letter of Tender meeting the requirements of the Tender. The Programme shall order the Works with due consideration to ease of access to particular project locations and the possibility of earlier than expected start of the Wet Season. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each program shall include.'

8.4 Extension of Time for Completion

Drafting note:

Depending on the date of the Contract, the Parties will agree criteria for the purposes of determining any Extension of Time pursuant to sub-paragraph (c), resulting from any effects of the Wet Season. The Contractor shall have no claim on the Employer or be entitled to additional cost as a result of any effects of the Wet Season and/or Extension of Time that may be granted.

11. DEFECTS LIABILITY

11.2 Cost of Remedying Defects

Insert at the end of Sub-Clause 11.2:

'Should any defects be discovered which are due to incorrect carrying out of Site Operations or incorrect handling of samples and cores whether during Site Operations or during laboratory testing the Engineer may at his sole discretion require that the work be repeated and the Contractor shall repeat such Site Operations and testing as are necessary to overcome the defects at his own cost.'

12. MEASUREMENT AND EVALUATION

12.3 Evaluation

Delete Clause 12.3 and replace with:

'Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work. However, a new rate or price shall be appropriate for an item of work if:

- (i) the work is instructed under Clause 13 [Variations and Adjustments],
- (ii) no rate or price is specified in the Contract for this item, and
- (iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described above, as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable

Cost of executing the work, together with reasonable profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates.'

14. CONTRACT PRICE AND PAYMENT

14.2 Advance Payment

Sub-paragraphs (a) and (b) are deleted and replaced with the following:

- '(a) deductions shall commence in the first Payment Certificate; and
- (b) deductions shall be made at the amortisation rate of one half (50%) of the amount of each Payment Certificate (excluding the advance payment and deductions and repayments of retention) in the currencies and proportions of the advance payment, until such time as the advance payment has been repaid.'

15. TERMINATION BY EMPLOYER

15.2 Termination by Employer

The following is inserted following sub-paragraph (f) within Sub-Clause 15.2:

- '(g) fails to comply with Sub-Clause 8.1 (Commencement of Works), or
- (h) is in breach of any of his representations, warranties, covenants or obligations under Sub-Clause 1.15.

In the case of breach of Sub-Clause 1.15 the Employer shall be entitled to recover from the Contractor all amounts paid to the Contractor under the Contract and the amount of any loss resulting from such termination or from a breach of Sub-Clause 1.15, in addition to any damages or other remedies available to the Employer under applicable law. The Contractor shall indemnify the Employer against any claims, losses, liabilities (including fines), damages, costs (including legal fees) and expenses incurred by, or awarded against, the Employer as a result of any breach of Sub-Clause 1.15 by the Contractor.'

18. INSURANCE

18.1 – General Requirements for Insurances

Delete sub-paragraph (b) of Sub-Clause 18.1 and replace with:

'copies of the policies for the insurances described in Sub-Clause 18.2 (Insurance for Works and Contractor's Equipment), Sub-Clause 18.3 (Insurance against Injury to Persons and Damage to Property), and Sub-Clause 18.5 (Professional Indemnity Insurance).'

18.2 – Insurance for Works and Contractor's Equipment

The following is inserted on line one after 'Works, Plant, Materials':

', core samples, test results records and results obtained and made in the course of the Investigation'

The following is inserted on line two after 'full reinstatement':

'or replacement'

The following Sub-Clause is added:

18.5 – Insurance for Professional Indemnity

'The Contractor shall effect and maintain professional indemnity insurance. This insurance shall be for a limit per occurrence of not less than the amount stated in the Tender, with no limit on the number of occurrences. If an amount is not stated in the Tender, this Sub-Clause shall not apply.'

3. OTHER DOCUMENTS FORMING PART OF THE CONTRACT

3.1 FORM OF TENDER

Name of Contract: Ground Investigation for Pavua Hydropower Project

To: eleQtra Ltd

We have examined the Conditions of Contract, Specification, Drawings, Bill of Quantities, the other Schedules, the attached Appendix for the execution of the above-named Works. We offer to execute and complete the Works and remedy any defects therein in conformity with this Tender, which includes all these documents, for the sum of (*in currencies of payment*):

.....

Or such other sum as may be determined in accordance with eth Conditions of Contract.

We agree to abide by this Tender until.....and it shall remain binding upon us and may be accepted at any time before that date. We acknowledge that the Appendix forms part of this Letter of Tender.

Unless and until a formal Agreement is prepared and executed this Letter of Tender, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest or any tender you may receive.

Signature..... in the capacity of

Duly authorised to sign tenders for and on behalf of:

Address:

Date:

Appendix to Form of Tender (to be completed prior to the invitation to tender)

(NOTE: Relevant Clause numbers are shown in brackets)

[Note: with the exception of the items for which the Employer's requirements have been inserted. the following information must be completed before the Tender is submitted]

Item	Sub-Clause	Data	
Employer's name and address	1.1.22 & 1.3	eleQtra Ltd Eastgate House 16-19 Eastcastle St London United Kingdom W1W 8DA	
Contractor's name and address	1.1 2.3 & 1.3	TBC	
Engineer's name and address	1.1.2.4 & 1.3	MWH UK Ltd Buckingham Court Kingsmead Business Park Frederick Place High Wycombe Buckinghamshire United Kingdom HP11 1JU	
Time for Completion of the Works	1.1.3.3	17	weeks
Defects Notification Period	1.1.3.7	365	days
Electronic transmission systems	1.3		
Governing Law	1.4	English	
Ruling language	1.4	English	
Language for communications	1.4	English	
Time for access to the Site	2.1	5	days after Commencement Date
Amount of Performance Security	4.2	Nil	% of the Accepted Contract Amount, in the currencies and proportions in which the Contract Price is payable
Normal working hours	6.5	Unrestricted	
Delay damages for the Works	8. 7 & 14.	Nil	% of the final Contract

	15(b)		Price per day. 1n the currencies and proportions in which the Contract Price is payable
Maximum amount of delay damages	8.7	Nil	% of the final Contract Price
Total advance payment	14.2	Nil	% of the Accepted Contract Amount
Number and timing of instalments	14.2	N/A	
Currencies and proportions	14.2	100	% in USD\$ % in
Start repayment of advance payment	14.2(a)	N/A	Where payments are% of the Accepted Contract Amount less Provisional Sums
Repayment amortisation of advance payment	14.29(b)	N/A	%
Percentage of retention	14.3	5	%
Limit of Retention Money	14.3	10	% of the Accepted Contract Amount
Minimum amount of Interim Payment Certificates	14.6	5	% of the Accepted Contract Amount

If payments are only to be made in a currency/currencies named on the first page of the Letter of Tender

Currency/currencies of payment	14.15	N/A	as named in the Letters of Tender
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If some payments are to be made in a currency/currencies not named on the first page of the Letter of Tender

Currency of payment	14.15		
Currency Unit	Percentage payable in the Currency	Rate of exchange: number of Local per unit of Foreign	
Local: [name]			
Foreign: [name]	United States Dollars – 100%		
Foreign:			

[name]

Periods of submission of insurance:

- | | | | |
|---------------------------|------|---|------|
| (a) evidence of insurance | 18.1 | 5 | days |
| (b) relevant policies | 18.1 | 5 | days |

Maximum amount of deductibles for insurance of the Employer's risks 18.29(d)

Minimum amount of third party insurance 18.3

4. SPECIFICATION AND SCHEDULES

4.1 SPECIFICATION

The specification shall be the “*UK Specification for Ground Investigation Second Edition*” published by Institution of Civil Engineers, UK Publishing in 2012, together with the information, amendments and additions as described in the Schedules of this RFP (collectively the “Specification”).

- Schedule 1. Information and site-specific requirements
- Schedule 2. Exploratory holes
- Schedule 3. Engineer’s Representative’s Facilities
- Schedule 4. Specification amendments
- Schedule 5. Specification additions

In so far as any of the numbered Appendices, Substitute, Additional or Amended Clauses may conflict or be inconsistent with any provisions of the above mentioned Specification then the numbered Appendices, Substitute, Additional or Amended Clauses shall always prevail.

Any Clause in the Specification, which relates to the work or materials not required for the Investigation shall be deemed not to apply.

Where Manufacturers’ or Suppliers’ names are stated or particular references to brand names are given, the words ‘or equivalent approved’ shall be deemed to be written immediately following such names. In this context, the word ‘approved’ means approved in writing by the Engineer.

The ground investigations are to be undertaken in accordance with the latest version of BS 5930, and its associated complementary standards. Where the Contractor wishes to propose alternative standards then these must be agreed in advance with the Engineer and must be to internationally recognised Standards.

4.2. SCHEDULES

Schedule 1. Information

S1.1 Name of Contract

Pavua Hydropower Project Site Investigation

S1.1.1 Project Information

The purpose of this assignment is to investigate the site of the proposed Project, a hydropower dam (and associated borrow pit / quarry), located in the Sofala Province in Central Mozambique.

MWH UK Ltd. ("MWH") has been appointed by eleQtra Ltd. to provide technical assistance with regard to the Investigation.

The site is located about 130 km north-west of Beria in the Sofala District of Mozambique. Drawing No. **41523803/0/G/0001** shows the project location plan and vicinity plan.

The Project, as currently planned and shown on Drawing No. **41523803/0/G/0002**, is comprised of a 100 m high, 950 m long (crest length) Roller Compacted Concrete (RCC) dam complete with integral spillway and power station. The purpose of the investigation is to conduct an exploration program to provide basic geotechnical data to enable the layout to be reviewed and design the project elements.

S1.2 Engineer's Representative

The Engineer's Representative for the Project will be appointed by MWH UK Ltd.

Address: MWH UK Ltd
Buckingham Court
Kingsmead Business Park
Frederick Place
High Wycombe
Buckinghamshire
United Kingdom
HP11 1JU

Details of powers delegated Engineer's Representative to the will be provided under separate cover prior to commencement of the investigation.

S1.3 Description of the Site

The Project site is located in a sparsely populated area of central Mozambique (Sofala Province), some 130 km north-west of Beria. The Pungwe River flows northwest to southeast through the project site. The river channel at the proposed dam site is typically around 30 m wide and flanked on both sides by alluvial terraces standing some 5 m above the river channel.

The river margins are occupied by extensive areas of bush and alluvial detritus interspersed with rock outcrops that range in size from a few metres squared to more extensive exposures measuring several tens of metres squared. Isolated rock outcrops are also visible along the base of the valley slopes and also within the river channel.

The valley side slopes away from the river channel are typically quite steep (approximately 1v on 2-2.5h or locally steeper) and appear to be heavily vegetated throughout.

Access to Project site is from the EN 1 road, approximately 17 km from the main EN 1 bridge crossing on the Pungwe River (50 km north of Inchope) and 20 km south from Gorongosa. The turn off point was located at Lat 18° 52' 14 " / Lon 34° 5' 59", some 1.5 km north of the village of Gire. From here, the old E 215 (now an unpaved dirt track) leads from the main EN 1 highway to the Pungwe River, over a length of about 11.5 km. The track passes through bush land and generally follows the ridge lines and high ground, with no major river crossings noted along its entire length. A few isolated communities / farms were noted along the route. The dirt track terminates a few hundred meters short

of an old stone bridge over the Pungwe River that was destroyed during the civil war. The proposed dam site is located 3 km downstream of the bridge, with no vehicle access beyond the bridge.

There is currently no vehicular access to any part of the proposed dam and quarry site and the Contractor shall be fully responsible for all access requirements to the site for the purpose of performing the investigation.

Tenderers are required to attend the site visit as a condition of submitting a proposal for the proposed investigations. At a minimum, the Contractor shall visit the dam and quarry site and is encouraged to visit all areas of the alignment. The Site Visit is intended to provide the prospective bidders with a general impression of the site conditions for use in planning the work and preparation of their proposals and minimize the potential for delays to the Project schedule. It shall be the sole responsibility of the Contractor to fully determine access, details and conditions at the work site, water supplies, equipment and facilities required to complete the work and all other matters that may affect completion of the work within the allotted schedule.

It is the Contractor's responsibility to provide all equipment and logistic support to safely perform the required work. These responsibilities will include, but not necessarily be limited to, transportation for equipment and personnel, communications, sanitary facilities, security, and public safety personnel and facilities.

The Employer wishes to emphasise the importance of maintaining appropriate health and safety management and back-up resources to facilitate the efficient and effective procurement of high quality ground investigation information in a timely manner, without any health and safety accidents or incidents, as far as is reasonably practicable. There is currently ongoing tension between government and opposition forces (RENAMO) in Mozambique which has resulted in heightened security risks in the area. The Contractor is responsible for monitoring the on-going security developments and reacting accordingly. The Contractor is responsible for any security arrangements of his staff and those of the Employer's. The Contractor shall be responsible for carrying out a detailed site risk assessment.

A Site Location Plan is presented on **Drawing No. 41523803/0/G/0001 (Appendix A)**.

S1.4 Main works proposed and the purpose of this contract

A ground investigation is required to characterise the nature and condition of the ground and groundwater at the proposed dam site and also at the proposed site of the borrow / quarry area associated with the Project. The investigation shall provide a detailed assessment of the site providing information on the nature of the strata encountered as well as prevailing groundwater conditions.

S1.5 Scope of the Investigation

This RFP is for the geotechnical ground investigation works for the scheme as described in Section S1.4 and will comprise:

- Mobilization and demobilization;
- Establishment and logistic support of temporary camp for crew and *Engineers*;
- Geological and geomorphological mapping;
- Seismic refraction surveys (with Interpretative Reporting);
- Overburden drilling;
- SPT sampling and U100 sampling;
- River water sampling;
- "HQ" size rock coring;
- Oriented rock coring;
- Oriented acoustic televiewer logging;
- Preparation of televiewer logs;
- Permeability testing in overburden;
- Water pressure testing in rock;
- Point load testing on site

- Observation trenches and sampling;
- Preparing and maintaining of records, driller's logs and reports;
- Packing, temporary storage, and transporting samples for final storage;
- Backfilling test pits, trenches and boreholes;
- Construction of piezometers;
- Groundwater monitoring and sampling during investigation period;
- geotechnical/geochemical laboratory testing; and
- factual reporting.

All associated sampling, in-situ testing, logging and laboratory testing shall be carried out in accordance with techniques outlined in BE EN ISO 14688 Part 1 and Part 2, BS EN ISO 14689-1 and BS EN ISO 17892 as appropriate. Any alternative standards proposed by the Contractor will need to be approved by the Engineer in writing before works can commence.

The Specification for this work shall be "UK Specification for Ground Investigation Second Edition: 2012", published by ICE Publishing except where modified by the following.

The ground investigation works is summarised as follows with the exploratory hole locations shown on **Drawing No.'s 41523803/0/G/0003 and 41523803/0/G/0004**. The drill-hole locations shown are proposed at this stage and the final locations will be determined on site. The Engineer retains the right to relocate borings and to specify the order of work.

- Geological and geomorphological mapping of the proposed dam site;
- 10 No. Seismic Refraction traverses;
- 5 No. vertical rotary cored drill holes (HQ-Size) to a maximum drilled depth of 75 m below ground level at the proposed dam site;
- 2 No. inclined rotary cored drill holes (HQ-Size) to a maximum drilled depth of 40 m below ground level;
- 3 No. vertical rotary cored drill holes (HQ-Size) to a maximum drilled depth of 35 m below ground level at the proposed borrow/quarry site;
- In-situ testing (SPTs) in overburden deposits;
- Class 1 quality samples of cohesive materials (U100 thin walled sample tubes), where encountered in sufficient quantity to enable a sample to be retrieved;
- Variable head permeability testing within overburden deposits;
- Single stage packer permeability testing within rock;
- Detailed logging of cores required by a ground specialist / experienced Engineer. Logging shall include detailed assessment weathering grade, rock quality designation (RQD), discontinuity spacing etc. Samples shall be selected by the Engineer for geotechnical analysis;
- Installation of 38 mm standpipe piezometers (complete with marker posts) – installation details to be confirmed on site. Groundwater sampling and fieldwork monitoring during the investigation period is required;
- 6 No. observation trenches to 4.5 m depth (or rockhead). Detailed logging and sampling for geotechnical testing is required;
- River water sampling.

Following completion of the site works, the following will also be required:

- All exploratory hole locations shall be positioned relative to the Universal Transverse Mercator (UTM) Zone 36L coordinate system in meters and WGS 84 datum. All survey works on site shall be relative to a Ground Control Point (reference PA 05) that is to be installed close to the dam site as part an aerial LiDAR survey (conducted by others in advance of the site investigation). The location and datum levels for the Ground Control Point will be provided to the successful bidder in advance of the site works. All surveys shall be conducted to within an accuracy of 0.05 m vertical and 0.5 m plan;
- A Factual Report (including photographs) to be produced by the Contractor upon completion of the site works, laboratory testing and groundwater monitoring.

Further details of the ground investigation required are included in Schedule 2 of this RFP.

The design of the ground investigation is based on a site walkover at the time of producing this Specification. Based on the findings of the investigation it may be necessary to undertake supplementary ground investigations should further information on the ground conditions or geotechnical parameters be required. Further investigation may also be required should ground related risks be identified during the works.

The scope of work identified in this section represents the approximate numbers, quantities, locations, depths, and details of the exploration program. The Engineer may make changes in the drawings, specifications, scheduling of the work, or the location, number and type of borings, in situ tests or samples, and geophysical surveys within the general scope, at any time by written order. If such changes add to or deduct from the Contractor's cost of the work, the Contract will be adjusted accordingly. The unit prices, however, will not be changed on account of the actual quantities being more or less than the estimated quantities indicated herein. All such work shall be executed under the conditions of the original Contract except that any claim for extension of time caused thereby will be considered and decided upon when such change is ordered.

S1.6 Geology and Ground Conditions

The Project area is located in a remote location along the Pungwe River that is typically around 30 m wide through the site area and flanked on both sides by alluvial terraces standing some 5 m above the river channel.

The river margins are occupied by extensive areas of bush and alluvial detritus interspersed with rock outcrops that range in size from a few metres squared to more extensive exposures measuring several tens of metres squared. Isolated rock outcrops are also visible along the base of the valley slopes and also within the river channel. The valley side slopes away from the river channel are typically quite steep (approximately 1v on 2-2.5h and locally steeper) and appear to be heavily vegetated throughout.

Information obtained from the Direcção Nacional de Geolgia, Carte Geológica (National Geological Map of Mozambique, scale 1: 1 000 000) (note: no assurance is given to its accuracy) indicates that the site is underlain by Monte Chissui Gneiss that belongs to the Chimoio Group of the Bráué Complex. The Monte Chissui Gneiss is described as felsic gneisses and metagranites that were named after Monte Chissui, located some kilometres south west of Chimoio town.

Pegmatite dykes that broadly trend north/south and north-north-west/south-south-east are shown cross the site. Foliation is shown to be largely striking north/south with some also striking north-west/south-east. Faults are shown trending north-east/south-west both upstream and downstream of the proposed dam site, although none are shown to run through the dam site itself.

No alluvium is shown to be present in the project area, although it is likely that this is a function of the map scale and alluvium associated with the Pungwe River is expected to exist at the proposed site. Although not shown on the maps, Colluvial deposits associated with material being eroded from the valley sides can be expected. For the purpose of this RFP, residual soil, colluvium, and alluvium deposits are described as overburden.

No previous investigations are known to have taken place at the proposed site.

S1.7 Schedule of Drawings

The proposed ground investigation layout plans showing indicative exploratory hole positions in relation to the proposed site layout is included in **Appendix A**. A summary of the drawings is presented below:

- 41523803/0/G/0001 – Site Location Plan
- 41523803/0/G/0002 – Ground Investigation Key Plan
- 41523803/0/G/0003 – Ground Investigation Plan – Dam
- 41523803/0/G/0004 – Ground Investigation Plan – Quarry

Actual exploratory hole locations are required to be set out by the Contractor, as per the exploratory hole location plans included in **Appendix A**, and agreed with the Engineer's Representative on site.

S1.8 General Requirements (Specification Section 3) Particular Restrictions/Relaxations

The Contractor shall submit method statements and risk assessments for all site works for the review and approval of the Engineer's Representative, in consultation with the Engineer and the Employer before site operations commence.

All licences, permits and permissions to undertake ground investigation works at the site are to be obtained by the Contractor in a timely manner to facilitate commencement of the ground investigation works as programmed. The Contractor will be required to be in complete compliance with the provisions of all permits.

The Contractor shall be responsible for determining the necessity for, and payment for all other permits and professional licenses, fees, etc. required by National, Provincial and other local authorities, involving employment of his personnel, import of equipment and materials, transportation of selected soil and rock samples outside of Mozambique and as required for the performance of the drilling and related work.

Prior to commencement of the fieldwork, the Employer will provide letters of advice to relevant authorities introducing the Contractor of his appointment, as well as letter of invitation for purposes of arranging any required entry VISAs.

S1.8.1 Quality Management System (Clause 3.3)

All work shall be carried out in accordance with a Quality Management System established in accordance with BS EN ISO 9001 (or other recognised International Standard).

S1.8.2 Professional Attendance (Clause 3.5.2)

The Contractor shall provide full time professional attendance on site for the duration of the ground investigation works with a suitably qualified and experienced English speaking Engineer nominated to act as Site Agent. The technical direction of all fieldwork shall be his/her responsibility.

The Contractor shall ensure that an experienced English speaking ground specialist (Engineering geologist/geotechnical Engineer) is available to log all cores. The Engineer shall have more than 5 years of relevant experience. The Contractor shall include a copy of his/her CV with their Proposal.

All Contractor's supervisory staff are subject to approval by the Engineer's Representative. The Engineer's Representative may reject a nominated person after arriving at site, if he/she considers that the person does not have the necessary skill, knowledge or experience to carry out the required work.

The Contractor shall advise of any members of site staff which are not permanently employed by the Contractor, and note that any substitute staff shall be of equivalent qualifications and experience to the satisfaction of the Engineer's Representative.

The Contractor will be expected to maintain close liaison with the Engineer's Representative and be in close attendance on the site to ensure that the highest quality of sampling and testing is achieved.

The Contractor shall make all necessary arrangements for the transport, temporary accommodation and protection of his own personnel and equipment. All transport dues, freight protection, temporary accommodation and handling charges shall be deemed to have been included in the Contract rates except as specifically allowed for by means of items in the Bills of Quantities.

S1.8.3 Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2)

None Specified.

S1.8.4 Hazardous ground, land affected by contamination and notifiable and invasive weeds (Clauses 3.7.1 and 3.22)

Landmines were placed over large parts of Mozambique during the civil war and Mozambique was declared mine free in 2015, the possible presence of mines cannot be ruled out.

S1.8.5 Additional information on services not shown on Contract drawings (Clause 3.7.2)

None known.

S1.8.6 Known/suspected mine workings, mineral extractions, etc. (Clause 3.7.3)

No mine workings are known about. Local surface exploration pits for gold deposits exist on sand deposits on the river banks close to the old demolished bridge, although none are believed to exist on site.

S1.8.7 Protected species (Clause 3.7.4)

None known.

S1.8.8 Archaeological remains (Clause 3.7.5)

None known.

S1.8.9 Site Security (Clause 3.11)

The site is located in a remote river valley. Security of the site and the working areas shall be the responsibility of the Contractor. The Contractor shall be responsible for all temporary storage and site welfare facilities for the duration of the works. All plant/equipment shall be left secure at all times when not in use.

S1.8.10 Traffic management measures (Clause 3.12)

There is currently no vehicular access to the proposed site. Upon award of the Contract the Contractor shall be responsible for improving access into the site and ensuring safe access and egress to all working areas.

The Contractor has an obligation to ensure that any clearance works required to improve access to the site are carried out in a controlled manner to minimise the amount of disruption to the local environment and indigenous population. To avoid any conflict, the Contractor shall be responsible for keeping the indigenous population informed of proposed improvement works to ensure that there is no impact on any locally sensitive areas (i.e. holy sites or burial grounds).

S1.8.11 Restricted working hours (Clause 3.13)

There are no restrictions on working hours unless instructed by the Engineer's Representative.

S1.8.12 Trainee site operatives (Clause 3.14.1)

Not applicable.

S1.8.13 Contamination avoidance and/or aquifer protection measures required (Clauses 3.15.2 and 3.15.3)

The Contractor shall operate an Environmental Management System compliant with ISO 14001 (or equivalent International Standard). The Contractor will be required to include pollution prevention measures within the site planning for all operations. In respect of ground investigation activities such considerations may include, but are not limited to: on site fuel storage, refuelling protocols, aquifer protection, storage and disposal of wastes, environmental impacts on other site users and neighbours, etc.

The Contractor shall be responsible for dealing with any waste, whether it be solid, liquid or gaseous, arising during the course of the ground investigation works, or after the works, and shall clean and make good all working areas to their previous condition or equivalent to the satisfaction of the Engineer's Representative.

Excess spoil shall be disposed of on-site at a location to be agreed with the Engineer's Representative.

Noise, dust and odour must be kept to a minimum at all times.

The Contractor shall develop and implement as necessary any contingency measures for the control of spillages of hazardous substances either on land or into local watercourses. Preventative measures to avoid any such spillages should be reviewed to avoid any recurrences.

In executing any ground investigation works precautions must be taken to secure the complete protection of rivers, streams, ditches other watercourses and water in underground strata against

silting, erosion or pollution. If notwithstanding these precautions, such silting, erosion or pollution does take place then immediate action should be taken to minimise the effect on the watercourse.

No material intended for or arising from the ground investigation works and no equipment or other items for use in executing the works shall be stored or disposed of in a watercourse or in a position where it may fall or be washed into a watercourse or water body. Any such material or equipment that gets into a water body shall be removed immediately.

Wash waters shall not be discharged to surface water drains, watercourses or soakaways. Detergents, including those described as bio-degradable shall not be discharged into surface water drains. Where possible washing activities shall be carried out in a designated area where wash water can be captured and controlled.

The Contractor shall obtain approval for all temporary discharges to and abstractions from watercourses from the appropriate Agency and other appropriate bodies and shall comply in all respects with their requirements.

No water shall be discharged from the site to any watercourse, drain or soakaway without obtaining the appropriate consents, permissions or licences.

S1.8.14 Maximum period for boring, pitting or trenching through hard material, hard stratum or obstruction (Clauses 2.8, 4.3 and 6.4)

During pitting, subject to the Contractor being satisfied that the obstruction or hard material is not part of buried services, the Contractor shall attempt to continue the excavation for a period of up to 0.5 hours. Should this not penetrate through the hard material the Contractor shall inform the Engineer's Representative, who may instruct what actions are to be taken.

During boring, the Contractor shall attempt to continue the drillhole for a period of up to 0.5 days, unless otherwise instructed by the Engineer's Representative and shall not allow for standing time. Should this not penetrate through the hard stratum, or obstruction, then the Contractor shall inform the Engineer's Representative, who may instruct what actions are to be taken.

The Contractor shall be responsible for all equipment required to advance the drill holes and the Employer or his / her representatives shall not be responsible for any wear or damage to equipment, nor replacement of any damaged equipment (including drill bits) during the investigation.

S1.8.15 Reinstatement requirements (Clause 3.16)

The Engineer's Representative shall be consulted prior to backfilling of any exploratory excavation, or demobilisation of plant at any location. On completion of drilling or excavation works, all exploratory holes, pit locations and access ways shall be reinstated to the satisfaction of the Engineer's Representative.

Observation trenches shall be neatly backfilled and left slightly proud of the ground surface to allow for settlement.

On completion of the site works, or at other periods if required by the Engineer's Representative, the Contractor shall reinstate the site and access routes and remove all plant, equipment, surplus material, spoil etc. to the satisfaction of the Engineer's Representative. The expense of reinstating avoidable damage shall be borne by the Contractor. Any ruts created while accessing the various exploratory hole locations shall be filled/levelled off using an excavator to the satisfaction of the Engineer's Representative.

Damage assessed as unavoidable and agreed by the Engineer's Representative shall also be reinstated and reinstatement costs shall be deemed to be included in the Contractor's Financial Proposal.

The Contractor shall dispose of non-contaminated spoil on site at a location to be agreed with the Engineer's Representative.

S1.8.16 Hygiene facilities required (Clause 2.20)

The Contractor shall provide temporary camp(s), provisions, and sanitary conveniences for use of all persons, including the Engineer staff, employed on the work site. For the purposes of planning, the Contractor shall assume the Engineer will have two (2) people on site full-time plus occasional visitors.

All sanitary conveniences shall be satisfactory to the Engineer and conform to the regulations of public authority having jurisdiction over such matters. At the completion of the work, such sanitary conveniences shall be removed and the premises left in such condition that they will not be deemed to be unsanitary. The location of the camp is the responsibility of the Contractor.

S1.8.17 Unavoidable damage to be reinstated by the Contractor (Clause 3.16.1)

Any damage to surfaces made during the transit of equipment (e.g. rutting, ground disturbance) shall be reinstated by the Contractor. The expense of reinstating avoidable damage shall be borne by the Contractor. Damage assessed as unavoidable and agreed by the Engineer's Representative shall also be reinstated by the Contractor.

S1.8.18 Accuracy of exploratory hole locations (Clauses 3.19 and 3.20)

The approximate locations of the exploratory holes are shown on the drawings provided (**Appendix A**); final locations are to be agreed on site with the Engineer's Representative. The Engineer's Representative may after consultation with the Contractor, vary the location and depth of any exploratory work and the sequence or quantity of in-situ testing depending on the actual site or ground conditions encountered.

The Contractor shall be required to survey positions of all exploratory holes and submit co-ordinates and reduced levels relative to a Ground Control Point (to be installed on site by others in advance of the works) for all as-built exploratory hole locations to within +/- 0.5 m in plan and +/- 0.05 m in elevation. As-built drawings showing the location and elevation of all exploratory holes shall be completed and presented with the Contractor's factual report.

The Contractor shall be responsible for ensuring that the Ground Control Point remains protected (and undamaged) throughout the duration of the Contract.

S1.8.19 Photography requirements (Clauses 3.25)

Photographs are required for all recovered samples (cores), trial pits, trial trenches and observation pits.

S1.8.20 Geological and Geomorphological Mapping

Geological and geomorphological mapping of the proposed dam site is to be carried out by the Contractor. The extent of the survey area is shown on Drawing No. **41523803/0/G/0003**. Mapping will be carried out in accordance with international best practice (*Brunsdon et al*, 1975, Quarterly Journal of Engineering Geology (London), 8, 227- 253) and will record all geological and geomorphological features at the proposed dam site. The mapping will record *inter alia* features such as:

- Overburden deposits (extent and nature);
- Rock outcrops (including rock type and extent);
- Degree of weathering;
- Bedding (dip and dip direction);
- Joints (including direction, dip, frequency aperture, nature of infill etc.);
- Faults (including orientation, down-throw and offset);
- Foliation;
- Indication of material characteristics (including strength);
- Classification of slopes (including steepness, breaks of slope, material composition and possible mode of development)
- Location of ridges etc.;
- Approximate heights of river bank above river level;
- Any areas of unstable ground;
- Springs;
- Watercourses;
- Gullies;
- Fans / scree slopes; and,
- Evidence of large magnitude flood events or landslides.

The results of the mapping will be presented in AutoCAD format.

S1.8.21 Pre-start meeting/Inductions

A pre-start meeting, to be undertaken on site will be arranged before site operations commence to establish access/egress routes and working areas ahead of site mobilisation.

S1.8.22 Landowners and access routes

The Contractor will be responsible for notifying the Employer and the Employers Representative of the commencement date of the ground investigation works and anticipated occupation period, no less than two weeks in advance. The Employer will notify the authorities of the Sofala Province and District Government (the "Authorities") and the local community leaders. The Contractor will be responsible for procuring any necessary permits and licences to facilitate the ground investigation works to suit his proposed methods of working and his Terms of Reference.

S1.8.23 Working areas and fencing

Working areas are shown on the Contract Drawings and shall be agreed on site by the Engineer's Representative prior to commencement of the works and arrangements / health and safety measures made to protect site workers, livestock and the general public during the works.

All fencing, signage, security and health and safety measures shall be implemented by the Contractor to the satisfaction of the Employer and Engineer's Representative.

S1.8.24 Services

The site is located in a remote river valley location that is away from any significant population. It is unlikely that there are any services in the area.

S1.8.25 Complaints and interaction with the local community and/or site users

The Contractor shall maintain a record of all complaints received regarding the ground investigation works, and shall promptly notify the Employers Representative of any complaints.

S1.8.26 Sub-Contractors

The Contractor shall indicate any sub-Contractors they propose to use during the ground investigation works as part of their Tender.

Any sub-Contractor shall require the prior approval of the Employers Representative. The Contractor shall be responsible for the services provided by the sub-Contractor and shall be liable for any defects and omissions arising there from.

S1.8.27 Contractor's compound

The location of the Contractor's compound(s) shall be discussed at the pre-start meeting. The design, construction and maintenance of that compound shall be Contractors responsibility.

S1.8.28 Programme

An indicative programme for completion of the ground investigation works and factual reporting is set out in **Table 1.0** below. If the Contractor cannot achieve this then they must contact the Engineer's Representative in writing. This indicative programme is based on two rigs operating simultaneously.

Table 1.0: Indicative Ground Investigation Programme

Phase	Duration	Cumulative Duration from Award	Notes
Mobilisation to Site	2 weeks	2 weeks	To include preparation of all risk assessments and method statements and contract programme
Intrusive Investigation Fieldwork	8 weeks	10 weeks	Includes groundwater and quarry sampling. Excludes post fieldwork monitoring
Preliminary Engineering Logs (and blank lab test schedules)	1 week	11 weeks	To be produced during course of site works, within 5 working days of completing individual exploratory holes. Last set of Engineering logs to be issued within 3 working days of completing all fieldwork.
Laboratory Testing	3 weeks	14 weeks	Blank schedules to be issued to the Engineer's Representative within 1 week of completing individual exploratory holes, and scheduling will be undertaken within a further 1 week (2 weeks total). Last schedule to be issued within 1 week of completing all fieldwork.
Draft Factual Report Issue	1 week	15 weeks	To be issued to Engineer's Representative.
Final Factual Report Issue	2 weeks	17 weeks	Presuming Engineer's comments on the draft report will be provided within 1 week of issue.

The period of time required for checking of the draft reports by the Employers Representative shall be one week, unless otherwise notified.

The Contractor may elect to undertake ground investigation works at more than one position simultaneously. This may reduce the overall duration of the works and should be indicated on the Tender for review.

A full set of checked and approved preliminary engineering logs for the ground investigation works shall be submitted to the Employer's Representative no later than 5 working days after completion of the fieldwork.

The Contractor is required to submit a programme for the site works; the programme should be resourced and dated with details of labour and plant proposed. This programme shall insofar as reasonably practicable meet the timescales given in **Table 1.0** above.

The Contractor is required to submit an approved Method Statement, Risk Assessment and Programme for all ground investigation works seven (7) days before site operations commence.

S1.9 Percussion boring (Specification Section 4) Particular Restrictions/relaxations

None Specified.

S1.10 Rotary drilling (Specification Section 5) particular restrictions/relaxations

S1.10.1 Augering requirements and restrictions (Clauses 5.1)

None Specified.

S1.10.2 Particular rotary drilling techniques (Clause 5.2)

Rotary Core drilling to recover cores in rock is required. Borehole locations and specific works requirements are provided in **Appendix A** and Schedule 2 respectively. Attention is drawn to Schedule 4.1 indicating the core recovery requirements. Initial drill-hole diameters shall allow for casing through voids and highly fractured zones.

Drilling shall advance through overburden deposits and where present, the materials shall be characterised using in site Standard Penetration Testing (SPT). The Contractor is required to include with his tender details of his methodology for obtaining Class 1 (U100 thin walled sample tubes) samples of cohesive material where encountered.

The Contractor may be required to undertake variable head permeability testing within overburden deposits. Any such testing shall be directed by the Engineer's Representative.

S1.10.3 Drilling fluid type and collection (Clause 5.3)

The drilling flush shall be clean water. All flush returns must be collected and contained to prevent uncontrolled release into the environment. All arising shall be disposed of at an approved location to be agreed with the Engineer's Representative. The use of polymer flushes shall only be permitted if directed by the Engineer's Representative.

S1.10.4 Rotary core drilling equipment and core diameter (Clauses 5.4.1, to 5.4.5 inclusive).

All cores shall be "HQ" size (63.5 mm internal diameter) using bottom/face discharging diamond bits. Core barrels shall have a longitudinally split inner-barrel (Longyear triple-tube, or similar) to allow the recovered samples to be observed and extracted without disturbance.

The core barrel shall be removed from the drill hole as often as required to obtain the best possible core recovery. Care shall be taken to maintain recovered core in a condition as near as possible to its natural state. Drilling shall produce cores of high quality and of not less than the required diameter throughout the core length. 100% core recovery in any single run should normally be obtained. Core recovery of less than 90% in any drill run will not normally be acceptable unless the Engineer's Representative is satisfied that more than 90% recovery is impracticable under the prevailing conditions. If, in the opinion of the Engineer's Representative more than 90% recovery can be achieved, and/or the core quality could be improved, the Contractor, after consultation with the Engineer's Representative, shall take measures to improve the core recovery at the Contractor's own cost.

Core drilling shall commence with a 0.6 m long run as soon as weathered or sound rock is encountered or when required by the Engineer's Representative. Successive coring runs may be increased in length up to a maximum of 3.0 m, provided that the percent recovery from the previous run exceeds 95%.

Whenever the percent recovery from any run is less than 95%, the next succeeding run shall be shortened to one-half the length of the last run, except that runs shorter than 0.60 m will not be required.

The core barrel shall be removed from the holes immediately if blocking of the bit or grinding of the core is indicated by the drill behaviour or water pressure, regardless of the length of run that has been made.

Approval shall be sought from the Engineer's Representative prior to the termination of each drill hole. In the event that any drillhole is abandoned short of its scheduled depth, for reasons other than the Contractor's drilling techniques or malfunction of equipment, the Engineers Representative reserves the right to request that the drillhole be relocated to a new position and re-drilled. The costs associated with repositioning the rig and re-drilling the drill hole may be chargeable by the Contractor and shall be based on the rates tendered. Any down time associated with delays resulting from the Contractor's performance shall not be reimbursed by the Employer.

Cores shall be stored in core boxes that shall be soundly constructed and fitted with stout carrying handles, fastenings and hinged lids. The total weight of the box and cores together shall be limited to an appropriate value. All core sticks shall be wrapped in clear Clingfilm to preserve moisture content. All details relating to the storage, packing and labelling of cores are stipulated in Clause 5.4.5

S1.10.5 Core logging (Clause 5.4.6)

Unless otherwise instructed by the Engineer's Representative, all cores shall be examined, photographed and logged on site within four working days of the cores being recovered. Where cores are to be examined and/or photographed, it shall be done in carefully controlled manner so as not to damage the cores.

All logging shall be in accordance with Clause 5.4.6 and described in accordance with BD EN ISO 14688-1, BS EN ISO 14689-1 and BS 5930 by an experienced English speaking ground engineer.

All core logging shall be carried out at a dedicated part of the site that is established solely for the logging and storage of cores. The dedicated part of the site shall include all necessary facilities required for core logging.

S1.10.6 Core sub-samples for laboratory testing (Clause 5.4.7)

The Contractor shall provide a schedule of core samples to the Engineer's Representative such that laboratory testing of rock samples can be provided.

S1.10.7 Address for delivery of selected cores (Clause 5.4.8 and 5.4.9)

The Contractor shall be responsible for the cores and samples and shall provide a suitable location for temporary storage of cores to protect them against theft, loss, or damage during drilling of the hole. The Contractor shall deliver samples to the laboratory for conducting required testing.

After completion of the hole, all cores and boxes will become the property of the Employer.

The Contractor shall deliver core boxes to the storage area designated by the Employer. The delivery address shall be provided to the Contractor nearer the time. For the purposes of pricing, the Contractor shall assume that the maximum distance that the cores shall be required to be transported to shall be Beira, Mozambique.

S1.10.8 Rotary open-hole general requirements (Clause 5.5.1)

None Specified.

S1.10.9 Rotary open-hole drilling for locating mineral seams, mine workings etc. (Clause 5.5.2)

None Specified.

S1.10.10 Open-hole resonance (sonic) drilling (Clause 5.6.1)

None Specified.

S1.10.11 Resonance (sonic) drilling with sampling or continuous coring (Clause 5.6.2)

None Specified.

S1.10.12 Backfilling (Clause 5.7)

None specified unless specified by the Engineer's Representative.

S1.10.13 Core photographic requirements (Clause 5.8)

All cores shall be photographed in a fresh condition prior to logging on site at the dedicated core logging area. All core photography shall be carried out in accordance with the requirements of Clause 5.8).

Core photographs shall be taken using a minimum camera resolution of 10 megapixels. This photography shall be carried out in controlled conditions such that the colour temperature of the lighting can be maintained at a constant level. Each frame shall contain no more than two core boxes together. Photographs shall be in focus with colour charts, scales and core box labels clearly set out.

Sample photos shall be provided to the Engineer's Representative for review and acceptance at an early stage. Sub-standard core box photographs will be rejected and the Contractor will be required to make good at his own expense.

S1.11 Pitting and trenching (Specification Section 6) particular restrictions/relaxations

S1.11.1 Indirect detection of buried services and inspection pits (Clauses 3.83 and 6.1)

None Specified.

S1.11.2 Restrictions on plant or pitting / trenching methods (Clauses 6.2 and 6.3)

Trial pit depths, locations and specific works requirements are provided in **Appendix A** and Schedule 2 respectively.

Where access allows the Contractor shall use a mechanical excavator but where this is not possible hand digging shall be used. Where necessary observation pits shall be safely and adequately shored or timbered and if ground conditions required it they shall be close timbered to facilitate safe access for inspection, logging and sampling purposes.

The observation pits may be kept open and de-watered for inspection from time to time during the course of the works. The Contractor shall provide on the site such ladders as may be needed to inspect the pits.

The Contractor shall be responsible for the design, installation and maintenance of all temporary supports to enable safe access into the excavations. The Contractor shall make available to the Engineer's Representative upon request any calculations relating the design of his temporary works. No entry into the trenches shall be permitted without the required support being in place and signed off as safe to enter by the Contractor.

All airings from the excavation shall be stockpiled a safe distance from the open excavation to ensure that the excavations sides are not unduly loaded.

Trench dimensions shall be included on the log. All strata shall be recorded to all sides of the trench. Each strata shall be described in accordance with BS EN ISO 14688-1, BS EN ISO 14689-1 and BS 5930 by an experienced English speaking ground engineer. An indication of strength shall be provided by carrying on in situ field tests (such as a hand shear vane). Any obstructions (such as boulders) shall be recorded and an indication as to the size of the obstruction shall be provided.

An approximate volume (as a percentage of the total spoil) of material size greater than cobble size in the material arising shall be recorded on the log.

S1.11.3 Entry of personnel (Clause 6.5)

Entry into the excavations is required for inspection, logging and sampling activities. The Contractor shall be responsible for the safe entry of all personnel. As required by the Specification, all excavations should be treated as a confined space and measures shall be put in place by the Contractor to safeguard all personnel.

Gasses generated by organic alluvial deposits may exist on site and gas detectors should be used to check for its presence in deep excavations.

S1.11.4 Alternative pit and trench dimensions (clause 6.7)

Observation trenches shall be a minimum of 6 m in length and 1.0 m wide. Trenches shall be excavated up to 4.5 m below ground level, or rockhead, whichever is shallowest.

S1.11.5 Abstracted groundwater from land affected by contamination (Clause 6.9.2)

No contamination is anticipated.

S1.11.6 Backfilling (Clause 6.10)

All timber supports shall be removed where possible as the excavation is backfilled. All backfilled excavations shall be left proud of the surrounding ground surface to allow for post-backfilling settlement.

S1.11.7 Photographic requirements (Clause 6.12)

A detailed photographic record of the excavation and its arising is required. Photographs shall be taken with a high resolution digital camera and shall include a notice board that identifies the trench.

Photography shall be carried out in controlled conditions such that the colour temperature of the lighting can be maintained at a constant level. Three photographs per trial pit should be taken; 1 x short face, 1 x long face and 1 x excavated spoil. Minimum number of 5 photographs shall be taken per each trench. The trench photographs shall document all found underground obstructions, short trench faces, long trench faces (1 photo every 3 m) and excavated spoil. Sub-standard trial pit photographs will be rejected and the Contractor will be required to make good at his own expense.

S1.11.8 Artificial Lighting (Clause 6.12.2)

Only required if needed to improve conditions for photography.

S1.11.9 Provision of pitting equipment and crew for Engineer's Representative's use (Clause 6.13)

Any additional works shall be directed by the Engineer's Representative on site.

S1.12 Sampling and monitoring during intrusive investigation (Specification Section 7) particular restrictions/relaxations

S1.12.1 Address for delivery of selected geotechnical samples (Clause 7.6.1)

All samples shall be labelled, stored and transported in accordance with the *Specification* to the premises of the accredited testing laboratory (or else the *Contractors* premises) nominated in the Tender returns.

S1.12.2 Retention and disposal of geotechnical samples (Clause 7.6.2)

All samples shall be kept in store for a period of three months following receipt of the final factual report from the Contractor. After this time, the permission of the Engineer's Representative shall be sought for their disposal by the Contractor.

S1.12.3 Frequency of sampling for geotechnical purposes (Clauses 7.6.3 to 7.6.11)

Frequency of sampling shall be in accordance with the *Specification* in all exploratory holes. The Engineer's Representative reserves the right to vary sampling and testing requirements on site to suit the ground conditions encountered.

Where soil samples are taken at a depth corresponding to a boundary between two different materials, the Contractor shall clearly state which material the sample is associated with.

Class 1 open tube thin walled samples shall be taken where cohesive material is encountered.

Large bulk samples shall be retrieved from observation trenches (minimum 30kg).

In addition to large bulk samples retrieved from exploratory hole locations, 5 No. additional large bulk samples are required to be taken from a large sand deposit, located on the banks of the Pungwe River, downstream of the demolished bridge.

Groundwater sampling during drilling is not required. All groundwater samples shall be retrieved from the piezometer installations that shall be purged prior to sampling.

All appropriate sampling methods shall be undertaken in accordance with the *Specification*, and BS 5930:1999.

Attention is drawn to the sample storage and handling requirements of the "Concrete in Aggressive Ground, BRE Special Digest No. 1 (2005)" and the "Sulphate specification for structural backfills, TRL Report 447 (2005)" in respect of sulphate and pH testing. Suitable storage facilities appropriate to the proposed time of on-site storage shall be provided.

S1.12.4 Open-tube and piston sample diameters (Clause 7.6.5)

Open-tube sample diameters shall be 100 mm diameter and be of the thin-walled sampler type. Piston samples are not required.

S1.12.5 Retention of cutting shoe samples (Clause 7.6.5)

Retention of the cutting shoe sample is not required.

S1.12.6 Delft and Mostap sampling (Clause 7.6.12)

Not required.

S1.12.7 Groundwater level measurement during exploratory hole construction (Clause 7.7)

No specific requirements, beyond those included in the Specification are required.

S1.12.8 Special geotechnical sampling (Clause 7.8)

Thin walled U100 samples tubes are required in cohesive materials.

S1.12.9 Address for delivery of selected samples (Clause 7.9.2)

Not specified as no contaminated land anticipated.

S1.12.10 Retention and disposal of contamination WAC samples (Clause 7.9.3)

Not specified as no contaminated land anticipated.

S1.12.11 Frequency of sampling (Clause 7.9.4)

Not specified as no contaminated land anticipated.

S1.12.12 Sampling Method (Clause 7.9.5)

Not specified as no contaminated land anticipated.

S1.12.13 Headspace testing (Clause 7.9.8)

Not specified as no contaminated land anticipated.

S1.13 Probing and cone penetration (Specification Section 8) particular restrictions / relaxations

None specified.

S1.14 Geophysical testing (Specification Section 9) particular restrictions/relaxations**S1.14.1 Geophysical survey objectives (Clause 9.1.1)**

All geophysical survey works shall be carried out in accordance with BS 5930:2015 and a Specialist contractor's technical proposal.

i) Seismic Refraction Surveys

The principal objective of the seismic refraction geophysical surveying work is to determine the depth to bedrock beneath alluvium and colluvium in the valley floors and determine the weathered profile on the valley sides. The seismic refraction survey shall be capable of extending to depths of up to 50 m. Both p-wave and s-wave velocity profiles should be provided.

Seismic refraction surveys are required at those locations shown on the Contract Drawings and at other locations as deemed necessary by the Engineer's Representative. The technique employed shall be as rapid and versatile as possible. Equipment comprising a mechanical energy source (hammer or falling weight), multiple geophones and portable signal enhancement seismograph with on-site computing facilities for multi-layer resolution shall be acceptable, although the Contractor may propose alternatives using multiple recording channels etc. The Contractor shall include within his submission details of his proposed methodology.

Explosives shall only be used as approved by the Engineer. If accepted, the Contractor shall obtain all necessary permits and shall comply with all laws, rules, regulations and ordinances governing the use of explosives in Mozambique.

Geophysical surveying lines shall vary in length and location as shown on the Contract Drawings. Each line shall be cleared of all surface vegetation and shallow buried roots to ensure good geophone contact is made with the ground. Vegetation clearance shall be carried out in advance of the geophysical field operations to ensure that there are no delays to the geophysical surveying work.

On-site interpretation shall be carried out by personnel other than those required to clear vegetation, set out lines and take the field measurements.

Any necessary surveying or ground profiling required to assist in the geophysical interpretation shall be carried out. Payment for such surveying work is deemed to be included in the main survey item in Bill A (General Items).

The seismic refraction work is intended to be used primarily to interpolate between completed or partially completed boreholes, although it is envisaged by the Engineer that geophysical profiling may be necessary in advance of boring and drilling or may be required to extrapolate beyond the boreholes which have been completed or partially completed at that stage of the Contract.

ii) 'Down the hole' techniques (Optional)

All core holes shall be surveyed down the hole using a high resolution acoustic televiewer.

All surveying shall be carried out over the full depth of the drill holes with directional information used to orientate the images in real time.

The inclusion of an acoustic televiewer survey of the boreholes is optional at this stage. Tenderers are required to submit a price for carrying out these works, and also provide details of his proposed borehole acoustic televiewer equipment, personnel and typical outputs from previous studies to illustrate the performance and limitations of the technique. The requirement for completing an acoustic televiewer survey, or not, shall be confirmed on Tender Award.

S1.14.2 Requirement for Ground Specialist geophysicist (Clause 9.1.1)

The seismic refraction geophysical surveys shall be carried out by an experienced English speaking geophysicist. It is an essential requirement of this Contract that the results of the geophysical surveys shall be computed and interpreted by the geophysicist as far as possible in the field. Chart records, prints-outs, etc. shall be made available in English for inspection by the Engineer's Representative and the results of the interpretive work carried out on site shall be reported to him.

S1.14.3 Trials of geophysical methods (Clause 9.1.1)

Trials are required to determine the optimum equipment configuration to return the highest resolution data possible from the main traverse lines. It shall be deemed that all costs associated with conducting the trials are included within the Contractors price. All trials shall be carried out under the supervision of the Engineer's Representative.

S1.14.4 Types of geophysics required (Clause 9.1.1)

The following geophysical investigation techniques are required on site:

- Seismic Refraction Traverses

Optional Item (requirement to be confirmed upon award of Tender).

- High Resolution Acoustic televiewer (down the hole)

S1.14.5 Information provided (Clause 9.2)

Several of the seismic refraction surveys lines have been aligned with the drillholes both at the proposed dam site and the site of the proposed quarry/borrow area. It is intended that the survey works will be timed such that it will follow the completion of at least two drill holes to enable 'ground truthing' of the seismic trace. All data recovered from the main drilling investigation shall be available. No previous investigations have been carried out at the site.

S1.14.6 Horizontal data density (Clause 9.3)

Not Specified. Density spacing is to be agreed with the Contractor in advance of the works to ensure the highest quality data is obtained from the surveys.

S1.14.7 Level datum (Clause 9.4)

All surveys shall be carried out to the same datum as that used in the main ground investigation (i.e. Ground Control Point (reference PA 05)).

S1.14.8 Geophysical survey report (Clause 9.7)

Preliminary interpretive results shall be submitted in English to the Engineer's Representative within one week of the survey being carried out.

Interpretative reporting is required. The survey report shall follow the general form as detailed in the Specification. All reporting shall be in English.

S1.15 In situ testing (Specification Section 10) particular restrictions/relaxations**S1.15.1 Tests in accordance with British Standards (Clause 10.3)**

The following tests shall be carried out and reported in accordance with the appropriate standards. The Engineer's Representative may request additional in situ testing, depending on the ground conditions encountered during the investigation.

- Standard Penetration Test (SPT) (BS EN ISO 22476-3, BS EN 1997-2);
- Variable head permeability test in boreholes and piezometers (BS EN ISO 22282-1:2012 & BS EN ISO 22282-2:2012)
- Packer Permeability Test (BS EN ISO 22282-3:2012)
 - a) Single
 - b) Double.

S1.15.2 Hand penetrometer and hand vane for shear strength (Clause 10.4.1)

Hand vane testing is required on cohesive soils.

The hand vane shall be on an approved proprietary make with stainless steel vanes. The scale shall be suitably graduated. The procedure for the test shall be in accordance with the principals for the laboratory vane and in situ vane tests (detailed in BS 1377 part 7) and the manufacturer's instructions. Peak shear strength and remoulded shear strength shall be recorded.

The reported shear strength shall be the average of a set of three recordings in close proximity but avoiding interference between tests. Test giving inconsistent readings shall be reported and comments on the relevance of the test noted.

The Contractor shall ensure that a copy of the Manufacturer's calibration chart specific to the hand vane used on site is supplied to the Engineer's Representative to ensure that appropriate torque values are used using the vane.

S1.15.3 Self-boring pressuremeter and high-pressure dilatometer testing and reporting (Clause 10.5.1)

Not Specified.

S1.15.4 Driven or push-in pressuremeter testing and reporting requirements (Clause 10.5.2)

Not Specified.

S1.15.5 Menard pressuremeter tests (Clause 10.5.3)

Not Specified.

S1.15.6 Soil infiltration test (Clause 10.6)

Not Specified.

S1.15.7 Special in situ testing and reporting requirements (Clause 10.7)

Standard Penetration Tests

Standard Penetration Tests ("SPT") shall be carried out at the end of each drill run within the drillholes in granular overburden. Testing sequences may be altered during the course of the investigation following consultation with the *Engineer's Representative* to suit the actual ground conditions encountered.

Relevant calibration certificates, including SPT hammer efficiency certificates, shall be submitted to the Engineer's Representative prior to any testing being undertaken.

All in situ testing is to be carried out by personnel who have been trained and are experienced in the use of the equipment, the test methods and the recording of results, and will generally be performed by Engineers or Technical Assistants.

Variable head permeability testing

Falling head testing may be specified by the Engineer's Representative within overburden deposits.

Packer Permeability Testing

As required by the Engineer's Representative, the Contractor shall perform water pressure tests to determine hydraulic conductivities and obtain information on the water bearing characteristics of the bedrock. Use of drilling mud, bentonite, or other substances that may affect the permeability of the rock will not be permitted in these holes.

The Contractor shall provide:

- An adequate source of clear water;
- Electronic device(s) for accurately measuring water levels in boreholes;
- Pump(s) capable of delivering water at rates up to 2.5 l/s at net pressures up to 4 MPa (600 psi);
- Pneumatically inflatable single packers and/or double (straddle) packers with separations of 2 m to 6 m capable of sealing off portions of the hole under net pressures of up to 4 MPa (600 psi);
- Water meter(s) reading to the nearest 0.1 l accurate to within 10 percent;
- Gauge(s) for reading water pressures with ranges of 0.5, 1.0, 2.5, and 5.0 MPa (75, 150, 360 psi, and 750 psi) with an accuracy of 10 percent;
- Stopwatch(es);
- Valves and surge vessels to regulate flow and pressure;
- All piping, hoses, and other equipment necessary to conduct the tests; and
- An adequate supply of replacement parts and equipment.

All plumbing materials used for water pressure testing shall have a minimum inside diameter of 25 mm. All equipment shall be in first class working order and shall be subject to approval at all times.

The Engineer's Representative will require proof of recent calibration of the water meter(s) and pressure gauges(s) and a reasonable amount of testing at the Site to demonstrate that the equipment is working properly and accurately.

The Contractor shall calibrate the packer assembly, piping, and valves for friction loss as required prior to the start of testing in the presence of the Engineer's Representative. Friction loss adjustments shall be applied as needed in the calculation of water pressure test (Lugeon) results. A friction loss test shall be performed for each type of system used during the investigation the site.

The hole shall be advanced to the required depth(s) in accordance with the requirements of this Specification. Tests shall be conducted in accordance with the method of Houlsby (1976), or equivalent International Standard for Lugeon testing in rock that requires a series of increasing and then decreasing, step-wise increments in injection pressure. The hole shall be flushed with clear water prior to actual pressure tests. Tests shall be performed as the hole is advanced and at locations and intervals determined by the Engineer's Representative. Tests may be performed for the entire portion of the hole, or for isolated segments of the hole. The Engineer's Representative shall provide recommended packer inflation and injection pressure values. The following information shall be recorded:

- Hole number;
- Depth of bottom of hole;
- Depth of zone tested;
- Diameter of hole;
- Rate of water take;
- Depth of casing;
- Date and time of test; and
- Name of person(s) conducting the test.

For the purposes of pricing, the Contractor shall assume packers tests shall be single stage (i.e. single packer), down hole tests conducted at 6 m intervals. The Engineer's Representative reserves the right to vary the test frequency and the stage length.

S1.15.8 Interface probes (Clause 10.8)

Not Specified.

S1.15.9 Contamination screening tests (Clause 10.9)

Not Specified.

S1.15.10 Metal detection (Clause 10.10)

Not Specified.

S1.16 Instrumentation (Specification Section 11) particular restrictions/relaxations

S1.16.1 Protective covers for installations (Clause 11.2)

Drill holes are to be reinstated with raised protective covers where instructed by the Engineer's Representative. Each installation shall be marked by 100 mm diameter wooden marker post. Each marker post shall be completed such that it stands 1.5 m proud of the ground surface and shall be painted with horizontal red and white bands, to aid visual identification. Both the raised cover and the wooden post shall be clearly labelled with the instrument reference number.

S1.16.2 Protective fencing (Clause 11.3)

Not Specified.

S1.16.3 Standpipe and standpipe piezometer installations (Clause 11.4.1 and 11.4.2)

The installation of 38 mm groundwater monitoring piezometers shall be in accordance with the Technical Specification and Schedule 2. On attaining the full depth of each hole where an instrument is to be installed, the Contractor should inform the Engineer's Representative of the sequence of materials encountered and water strike/standing water levels. Details of installation location, diameter, depth and other details shall be instructed by the Engineer's Representative.

S1.16.4 Other piezometer installations (Clause 11.4.3)

Not Specified.

S1.16.5 Development of standpipes and standpipe piezometers (Clause 11.4.5)

Each piezometer shall be purged prior to groundwater sampling in accordance with BS ISO 14686 (2003).

S1.16.6 Ground gas standpipes (Clause 11.5)

Not Specified, unless otherwise specified by the Engineer's Representative.

S1.16.7 Inclinator installations (Clause 11.6)

Not Specified.

S1.16.8 Slip indicators (Clause 11.7)

Not Specified.

S1.16.9 Extensometers and settlement gauges (Clause 11.8)

Not Specified.

S1.16.10 Settlement monuments (Clause 11.9)

Not Specified.

S1.16.11 Removal of installations (Clause 11.10)

Not Specified.

S1.16.12 Other Instrumentation (Clause 11.11)

Not Specified.

S1.17 Installation monitoring and sampling (Specification Section 12) particular restrictions/relaxations

S1.17.1 Groundwater level readings in installations (Clause 12.2)

Groundwater levels shall be monitored in all exploratory holes at the commencement and end of each working shift and every time groundwater is encountered during boring (i.e. every groundwater "strike").

Monitoring of groundwater level in all piezometers shall take place on a weekly basis for the duration of the site works. The Contractor is responsible for groundwater monitoring. Monitoring shall be carried out using a 100 m long battery operated water level dipmeter with the cable graduated in metres (supplied by the Contractor).

At the onset of any groundwater monitoring the Contractor shall agree with the Engineer's Representative where all readings shall be related to, either ground level or top of casing. In either instance the depth to groundwater shall be recorded in metres below that reference point. The results shall be reported in m below reference point and metres above Ordnance Datum (m AOD). The depth to the base of the installation shall also be recorded during each visit.

S1.17.2 Groundwater sampling from installations (Clause 12.3.1)

Groundwater samples from installations are required. Samples will be analysed for water quality as specified in S1.19 using a portable hand held readout unit capable of reading (pH, turbidity, dissolved oxygen, electrical conductivity, temperature and redox). Additional testing may be specified by the Engineer's Representative.

S1.17.3 Purging/micro-purging (Clause 12.3.2)

Purging of the piezometer prior to sampling is required. Purging shall be carried out in accordance with the Specification.

S1.17.4 Ground gas monitoring (Clause 12.4)

Not Specified.

S1.17.5 Sampling from ground gas installations (Clause 12.5)

Not Specified.

S1.17.6 Other monitoring (Clause 12.8)

Not Specified.

S1.17.7 Sampling and testing of surface water bodies (Clause 12.9)

Testing of river water from the River Pungwe at the proposed dam site is required. 3 No. Samples will be analysed for water quality as specified in S1.19 and S1.20 and carried out in situ using a portable read out unit (pH, turbidity, dissolved oxygen, electrical conductivity, temperature and redox).

S1.18 Daily records (Specification Section 13) particular restrictions/relaxations

S1.18.1 Information for daily records (Clause 13.1)

The Contractor shall be responsible for providing daily records of the works carried out in accordance with the Specification.

The Contractor shall maintain daily contact with the Engineer's Representative on occasions when the Engineer's Representative is not present on site. The Contractor shall contact the Engineer's Representative without delay to report any incident, accident, disruption to progress, or completion or termination of an exploratory hole.

The Contractor shall also provide the Engineer's Representative with daily site records and journals within 1 working day of the period to which they relate. Daily reports and logs should include preliminary in situ test data and results where undertaken. Alternatively, should the Contractor have access to email facilities, electronic copies of the daily site records may be sent directly to the Engineer's Representative.

S1.18.2 Special in situ tests and instrumentation records (Clause 13.4)

Not Specified.

S1.19 Geotechnical laboratory testing (Specification Section 14) particular restrictions / relaxations

S1.19.1 Engineer's Representative or Contractor to schedule testing (Clause 14.1.1)

The Engineer's Representative shall schedule the tests, upon receipt of a list of available samples from the Contractor. The Contractor shall provide blank laboratory test scheduling sheets to the Engineer's Representative which should include the following information;

- Project details;
- Exploratory hole details; and
- Sample types and depths together with sample recovery details as applicable.

S1.19.2 Tests required (Clause 14.1.2)

At Tender Stage the following tests are envisaged. The scope of the testing requirements may change during the course of the investigation.

Soil

Particle size distribution (mechanical sieving and sedimentation as applicable);

- moisture content;
- particle density/specific gravity;
- bulk density (unit weight);
- liquid limit, plastic limit and plasticity index;
- unconfined compression;
- total and effective stress triaxials;
- compaction testing; and,
- shear strength testing.

All testing shall in accordance with BS 1377 / BS EN 1997-2 or other internationally recognised standard to be accepted by the Engineer.

S1.19.3 Specifications for tests not covered by BS 1377 and options under BS 1377 (Clause 14.2.1 and 14.1)

Rock testing is not carried out under BS 1377. Details of the rock testing requirements are provided in S1.19.5.

S1.19.4 UKAS accreditation to be adopted (Clause 14.3)

All laboratory testing shall be undertaken to UKAS/MCERTS or equivalent International accredited methods. Details of accredited tests shall be submitted to the Engineer’s Representative. Where UKAS/MCERTS or equivalent International accreditation has not been achieved for a specific test, approval to undertake the test shall be sought from the Engineer’s Representative prior to the test being undertaken.

S1.19.5 Rock testing requirements (Clause 14.5)

At Tender Stage the following tests are envisaged. The scope of the testing requirements may change during the course of the investigation.

Test	Standard
Natural water content of rock sample	International Society Rock Mechanics (ISRM) Suggested Methods Part 1:2: Page 83
Porosity / density using saturation and calliper techniques	ISRM Suggested Methods Part 1:2: Page 83
Slake durability index	ISRM Suggested Methods Part 2.2 (page 104)
Aggregate crushing value	BS 812
Ten percent fines	BS 812
Aggregate impact value	BS 812
Aggregate abrasion value	BS EN 1097-2:1998
Uniaxial compressive strength	ISRM Suggested Methods Vol 16, No. 2, pp 135-140, 1979
Young Modulus & Poisson Ratio	ISRM: R Ulusay & J.A. Hudson, 2007
Indirect tensile strength by Brazilian test	ISRM: Document No. 8: Part 2: pp 117-121 (1977)
Undrained triaxial compression with measurement of porewater pressure	ISRM: R Ulusay & J.A. Hudson, 2007
Direct shear strength of a single specimen	ISRM: R Ulusay & J.A. Hudson, 2007
i) AAR Tests	
Petrographic Examination of aggregates	ASTM C295 Standard Guide for Petrographic Examination of Aggregates for Concrete
Potential AAR (Mortar-Bar Method)	ASTM C1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
Length of Change of Concrete due to ASR	ASTM C1293 Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction

S1.19.6 Chemical testing for aggressive ground/groundwater for concrete (Clause 14.6)

Chemical testing for aggressive ground/groundwater for concrete is required and shall be specified by the Engineer's Representative.

S1.19.7 Laboratory testing on site (Clause 14.7)

Point load testing shall be carried out on site by the Contractor using a portable point load testing equipment. Point Load tests shall be conducted following Int. J Rock Mech. Sci & Geomech. Abstr. Vol. 22 No. 2, pp 51-60. 1985.

S1.19.8 Special laboratory testing (Clause 14.8)

None specified.

S1.20 Geo-environmental laboratory testing (Specification Section 15) particular restrictions/relaxations

Water samples obtained from the river and groundwater monitoring wells shall be tested on site using a portable readout unit for chemical / water quality testing and may include the following:

- pH, turbidity, dissolved oxygen, electrical conductivity, temperature and redox.

Additional geotechnical and geochemical testing may be specified by the Engineer's Representative if appropriate.

S1.21 Reporting (Specification Section 16) particular restrictions/relaxations**S1.21.1 Form of exploratory hole logs (Clauses 16.1 and 16.2.1)**

The Contractor shall prepare a preliminary log of each exploratory hole using an agreed proforma. The Contractor shall submit an example of his or her proforma with his Tender submission. For trial pits, a simplified version of the log and elevations showing each face of the pit shall be provided as appropriate. Preliminary logs shall be submitted to the Engineer's Representative within five (5) working days of completion of the exploration to which they refer and shall contain the information required for the exploratory hole logs, as detailed in the Specification.

S1.21.2 Information on exploratory hole logs (Clause 16.2.2)

The exploratory hole logs shall be to recognised International Standards and contain the all information as detailed in the Specification.

S1.21.3 Variations to final digital data supply requirements (Clause 16.5.1)

None Specified.

S1.21.4 Preliminary digital data (Clause 16.5.3)

None Specified.

S1.21.5 Type(s) of report required (Clause 16.6)

The following reports are required:

- A factual ground investigation report is required
- An interpretative geophysical report.
- A preliminary Fieldwork Report is required from the Contractor within 1 week of completion of the ground investigation works, to include Engineering Logs.

All reporting shall be in English.

S1.21.6 Electronic report requirements (Clause 16.6.3)

All draft and final factual reports shall be submitted in Adobe Acrobat PDF format. All reports shall be formatted in accordance with the following:

- All records shall be in Adobe Portable Document Format (PDF).
- All PDF documents shall be produced from within the source application or indirectly by using a post script or encapsulated post script file converter.
- Laboratory test data shall be summarised in excel format.
- Scanning shall only be permitted where the original is not in electronic format.

All PDF documents records should have unrestricted access i.e. with no security restrictions.

The site plans may be provided as an AutoCAD DWG or DXF drawing file. Where such digital information is provided the Contractor's exploratory hole layout drawing shall be returned in a similar digital format.

S1.21.7 Format and contents of Desk Study Report (Clause 16.7)

Not required.

S1.21.8 Contents of Ground Investigation Report (or specified thereof) (Clause 16.8)

All reporting shall contain the information as detailed within the Specification including *inter alia*, a description of the work carried out, with details of the specification, standards, site quality assurance ("QA") protocols, method statements, instrumentation, sampling, testing, monitoring and reinstatement.

All location plans and topographic maps within each report shall reference an agreed grid coordinate system. As-built exploratory hole location plans shall be included within the Contractor's factual reports.

S1.21.9 Contents of Geotechnical Design Report Genera (or specified part thereof) (Clause 16.9)

Not required.

S1.21.10 Times for supply of electronic information (Clause 16.10.1)

Not specified.

S1.21.11 Electronic information transmission media (Clause 16.10.2)

Not Specified.

S1.21.12 Report approval (Clause 16.11)

Not Specified.

S1.22 Particular health and safety requirements

The Contractor is to submit suitable, site specific method statements and risk assessments for all site work for review and approval by the Employer before the works commence.

All costs associated with preparation of supporting documentation and implementation of appropriate health and safety regulations is deemed to be included within the Contractor's rates.

The Contractor shall ensure that when using percussive or pneumatic equipment that the health and safety plans highlight the risk of vibration white finger.

The project site is in a remote area and the Employer wishes to emphasise the importance of maintaining appropriate health and safety management and back up resources to facilitate the works, whilst targeting zero accidents/incidents on site, as far as is practical.

Schedule 2. Exploratory holes

Hole ID.	Location	Scheduled Depth (m)	Approximate Ground Level (m)	Remarks
BH/01	Right Abutment	75 m	El. 197 m	Vertical rotary drill-hole with coring. Standpipe piezometer to be installed in boreholes at depths to be determined by the Engineer. Packer tests at 6 m intervals in rock, as directed by the Engineer.
BH/02		75 m	El. 140 m	
BH/03		70 m	El. 104 m	
BH/04	Powerhouse	40 m	El. 75 m	Inclined rotary drill-hole with coring. Packer tests at 6 m intervals in rock, as directed by the Engineer.
BH/05	Central – Left Bank	40 m	El. 75 m	
BH/06	Left Abutment	75 m	El. 135 m	Vertical rotary drill-hole with coring. Standpipe piezometer to be installed in boreholes at depths to be determined by the Engineer. Packer tests at 6 m intervals in rock, as directed by the Engineer.
BH/07		75 m	El. 194 m	
BH/08	Quarry	35 m	EL. 119 m	Vertical rotary drill-hole with coring.
BH/09		35 m	El. 145 m	
BH/10		35 m	El. 176 m	
OP/01	Right Abutment	4.5 m	El. 102 m	As specified in S1.11 and as directed by the Engineer.
OP/02	Central – Right Bank	4.5 m	El. 76 m	
OP/03	Central – Left Bank	4.5 m	El. 78 m	
OP/04	Left Abutment	4.5 m	El. 115 m	
OP/05	Central – Right Bank	4.5 m	El. 78 m	
OP/06	Left Abutment Ridge	4.5 m	El. 190 m	

* - depth of installations to be confirmed on site by Engineer’s Representative.

Notes:

Please note this is not an exhaustive list and reference should be made to the Technical Specification Schedules.

1. Actual exploratory hole locations are to be agreed on site with the Engineer’s Representative.

2. Rotary drill holes shall be terminated upon proving the scheduled depth and following approval from the Engineer's Representative. The Engineer's Representative may instruct an extension to the depth. All drilling shall be undertaken to obtain cores not less than HQ-Size.
3. Observation trenches shall only be terminated/backfilled following the approval from the Engineer's Representative.
4. The dimensions and locations of all underground obstructions found in observation trenches shall be recorded.
5. The elevation of the underground obstructions shall be recorded at the top of the obstruction. Changes in elevation of underground obstructions must also be recorded.
6. Installations shall comprise 38 mm piezometers fitted with top caps. Installation details will be specified by the Engineer's Representative on completion of drilling. Raised covers and marker posts will be required.
7. The number of exploratory holes may be changed in accordance with the ground conditions encountered and amendments to the proposed scheme.
8. Observation trenches shall be terminated at 4.5 m or rockhead (whichever is shallowest), or shallower should pit wall instability become evident. Temporary support design and installation to permit logging of the trial pit walls shall be the responsibility of the Contractor.
9. Photographs shall be taken of all cores and of both observation trenches and spoil during the site works.

Schedule 3. Engineer's Representatives Facilities

S3.1 Accommodation

The Contractor shall prepare an approved site for, provide and during the continuance of this Contract maintain, clean and light appropriate accommodation for the use of the Engineer's Representative and his staff for the whole of the Contract period or such part of it as the Engineer's Representative may instruct.

The Engineer's sleeping accommodation shall comprise 2 separate tents each to be fully protected from the weather and to be of 6-man capacity. In addition, a waterproof cover shall extend from 2 m behind to 5 m in front of each tent to provide covered and protected external working areas. The floors of the covered surface (including the tent) shall be raised above the ground surface. Each tent shall have two beds complete with mattress, bedding, pillows, blankets and mosquito nets.

Any additional facilities required to accommodate visiting staff shall be supplied by the Contractor as required and shall be to the same standard as above.

The Engineer's Representative and his staff shall be provided with three cooked meals each day, the supply and preparation of which shall be the responsibility of the Contractor.

Food for the Engineer and his staff shall include fresh meat and vegetables. Bottled mineral water shall be provided for the Engineer's use throughout the site operations.

The Engineer's Representative and his staff shall have access to refrigeration and cooking facilities at all times

S3.2 Furnishings

S3.2.1 The Engineer's accommodation shall be provided with a separate tent that shall include the following:-

- 1 No. desk
- 4 No. chairs
- lighting

S3.3 Services

Temporary water supplies - Arrangements shall be made for the supply and storage of water for the Engineer's Representative and his staff. Drinking water shall be clean, sterile bottled water from an approved source. The Contract rates shall be deemed to include for the costs of all such arrangements.

Sanitation - Proper temporary sanitation arrangements shall be provided to the approval of the Engineer's Representative and the Contractor shall ensure that facilities are maintained to a clean and sanitary condition at all times.

Communication - Suitable arrangements shall be provided to the approval of the Engineer's Representative. The system shall be capable of connecting the site with the outside world at any time of the day.

S3.4 Equipment for the Engineer

The Contractor shall provide and maintain in good condition and adjustment throughout the Contract period the following equipment for the exclusive use of the Engineer's Representative and his staff:-

- 2 No. 50 m long 'Fibron' tapes
- 2 No. 7.5 m tape measures
- 2 No. powerful torch lights with batteries as necessary
- 2 No. parangs / machete with protective sheath

These will remain the property of the Contractor on completion of the Contract.

S3.5 Transportation

The Contractor shall provide a four wheel drive vehicle with a minimum engine capacity of 2000 cc fitted with air conditioning. The vehicle should be fully licensed and insured and with all necessary fuel, oil, etc. All fuel receipts shall be passed to the Contractor for payment. The transport shall be available at all times for the sole use of the Engineer's Representative and staff. Items are included in the Bills of Quantities to cover the cost of supplying the vehicle on a weekly basis during the period of the investigation.

The vehicle shall revert to the Contractor at the end of the Contract Period. In the event of the vehicle breaking down or otherwise not being available, the Contractor shall immediately provide an alternative vehicle of a similar type. The vehicle shall be comprehensively insured with third party insurances required in Mozambique to permit the Contractor's driver and any member of the Engineer's staff to drive.

The Contractor shall be responsible for ensuring that there is vehicular access to the site compound. In the event that vehicular access to the dam site is not possible, then boat access to the dam site shall be provided by the Contractor. Provision and maintenance of the boat, along with an experienced driver, shall be the responsibility of the Contractor.

S3.6 Personal Protective Equipment for the Engineer's Representative

Rubber knee boots **with** steel safety toes, and approved safety helmets shall be provided as required for the use of the Engineer's Representative and his staff and the visitors to the site. Three sets of cotton overalls shall be made available for similar use.

The Contractor shall have available for the reasonable but not exclusive use of the Engineer's Representative any other instruments, equipment or materials that the Engineer's Representative may require for measuring, supervising, checking, testing, examining or setting out the works or material or items forming part of the works. All such instruments etc. shall be maintained in good condition and adjustment and will remain the property of the Contractor on completion of the Contract.

Schedule 4. Specification amendments

The following amendments are made to the *UK Specification for Ground Investigation Second Edition* published by Institution of Civil Engineers, UK Publishing in 2012.

Clause	Amendment	Description
Clause 3.5.2	Add the following	The professional attendant shall be responsible for informing all personnel on site employed by the Contractor of the specific requirements of this Specification.
Clause 3.15.1	Add the following	The Contractor shall take all necessary precautions to avoid causing any unnecessary damage to access roads, tracks, land, buildings and other features and shall deal promptly with any complaints by owners or occupiers. Care shall be taken to preserve the natural amenities of the area and to avoid damaging any trees and bushes in the vicinity of the site operations. No excavations shall be left unattended unless appropriately supported.
Clause 3.18	Add the following	The Contractor shall obtain the greatest possible information from each exploratory hole and careful drilling, excavation, sampling and observation shall take priority over speed of working. All reasonable precautions shall be taken to prevent surface materials entering the hole during boring or excavation. If such contamination should occur, the exploratory hole shall be cleaned out before advancing it further and a note made on the daily report.
Clause 7.1	Amend the clause to read:	Small disturbed samples shall not weigh less than 1 kg. They shall be placed immediately in airtight containers, which they should sensibly fill.
Clause 7.2	Amend the clause to read:	Bulk disturbed samples shall be representative of the zone from which they have been taken. Bulk disturbed samples shall weigh not less than 25 kg. Large bulk disturbed samples to be taken in trial pits shall weight no less than 50 kg. To aid ease of manual handling the sample may be placed in two bags of not less than 25 kg
Clause 7.6	Amend the clause to read:	Clause 7.6 of the Specification for sampling and testing frequency is amended to the following: The frequency of sampling and in situ testing is dependent on the ground conditions. Particular requirements are given in Schedule 1. In the absence of particular requirements or instructions from the Engineer's Representative, the intervals observed shall be as follows. In Observation Pits: a. Small disturbed samples shall be taken of topsoil, at 1 m intervals and where necessary, at each change of soil type or consistency; b. Large bulk disturbed samples shall be taken at variable depths to provide representative sampling of the ground conditions. Two large bulk samples are required per 1.5 m depth increment, unless instructed otherwise by the Engineer's Representative.

Schedule 5. Specification additions

Soil and rock logging shall be carried out by an experienced Ground Specialist (Geotechnical Engineer / Engineering Geologist) in accordance with BS EN ISO 14688-part 1 and 2 & BS EN IOS 14689-1. The geological stratum name shall be assessed for all strata at the time of logging, and included at the end of each stratum description.

Where weathered rock is encountered, its weathering grade shall be provided.

5. BILL OF QUANTITIES

5.1 PREAMBLE TO THE BILL OF QUANTITIES

The Bill of Quantities is to be read alongside the *Specification* for the Ground Survey Works, which shall be the "*UK Specification for Ground Investigation, Second Edition (2012)*", published by Institution of Civil Engineers, UK Publishing in 2012, together with the information, amendments and additions as described in this RFP.

- 1) In the Bills of Quantities the sub-headings and item descriptions identify the work covered by the respective items. The exact nature and extent of the work to be performed shall be ascertained by reference to the Conditions of Contract, the Specification, the Schedules and Appendices to the Specification, as appropriate. The rates and prices entered in the Bills of Quantities shall be deemed to be the full inclusive value of the work covered by the several items, including the following unless stated otherwise:
 - (a) Supervision, labour and all costs in connection therewith
 - (b) Supply of materials, goods, storage, facilities and services, and all costs in connection therewith, including wastage and delivery to site
 - (c) Plant and all costs in connection therewith
 - (d) Fixing, erecting and installing or placing of materials and goods in position
 - (e) All temporary works
 - (f) All general obligations, liabilities, and risks involved in the execution of the investigation as set forth or implied in the documents on which the tender is based
 - (g) Establishment charges, overheads and profit
 - (h) Bringing plant and sampling and in-situ testing equipment to the site of each exploratory hole; erecting, dismantling and removing on completion
 - (i) Removal of all equipment and services from site on completion.
- 2) All items not deleted from Section A of the Bills of Quantities (General Items) shall be priced and all items in subsequent sections against which quantities are entered shall be priced.
- 3) Where rates are not priced they shall have USD \$0.00 placed against them.
- 4) Professional attendance associated with the description of cores and samples and other duties as required by the Contract shall be included in the appropriate rates. When full time professional attendance on site is required this shall be paid for under item A3 of the Bills of Quantities.
- 5) Rates for moving plant and equipment to the site of each exploratory hole shall allow for the formation of access routes, and making - good access routes and working areas on completion as required by the Contract.
- 6) The rates for moving rotary drilling plant to the site of each hole shall include for setting up over a previously formed borehole.
- 7) Payment for forming exploratory holes shall be based on:
 - (a) Full thickness of strata investigated and described in accordance with the Specification
 - (b) Depths measured from ground level
 - (c) Depth measured from original ground level where an inspection pit has been excavated
 - (d) That part of a drillhole below the bottom of a borehole where a drill hole has been ordered to continue from the bottom of a borehole
 - (e) Core recovery of at least 90% in any core run, unless the Engineer is satisfied it cannot be achieved

- (f) Volume calculated as measured length x measured depth x specified width for trial and observation trenches.
- 8) Rates for forming exploratory holes shall allow for:
- (a) Casing installation where necessary, and removal
 - (b) Dealing with surface water
 - (c) Backfilling with arisings
 - (d) Supply of daily report and preliminary log
 - (e) Additional site supervision of non-accredited drillers
 - (f) Disposal off site of excavated material not required for reuse, including contaminated ground and groundwater.
- 9) No standing time for drilling, test pit or geophysical survey plant and equipment will be paid to the Contractor.
- 10) The rates for sampling and in situ testing shall allow for the standing time of associated plant. All in situ tests shall be paid for on a quantity basis of successful tests.
- 11) The rates for installation of instruments shall allow for:
- (a) Clearing and keeping hole free of unwanted materials
 - (b) All costs associated with equipment, installation, specified seals, surround and backfill materials excluding backfill below the instrument
 - (c) Proving correct functioning
 - (d) Delays due to installations.
- 12) The rates for testing shall include for:
- (a) The supply of a copy of the preliminary test results to the Engineer
 - (b) The cost of moisture content or density determinations where they form part of the test.
- 13) The rates for recording of water level or gas measurement shall allow for notices of re-entry to the Engineer, owners or occupiers affected by the location or access route.
- 14) Items for the supply of the master and copies of the interpretative report shall include provision of a full draft report and final report, following incorporation of all comments by the Engineer.

Units of measurement

- 15) The following abbreviations shall be used for the units of the measurements:

Millimetres	mm
Metre	m
Kilometre	km
Square millimetres	mm ²
Square metre	m ²
Cubic metre	m ³
Square metre per day	m ² /day
Kilogramme	kg
Tonne	t
Sum	sum

Number	nr
Hour	h
Week	wk
Vehicle week	v.wk
Item	item
Day	day
Specimen day	sp.day

- 16) The amount of work may vary from the figures shown in the Bills of Quantities depending on the investigation as it proceeds.
- 17) The rates for forming exploratory holes shall include for backfilling. Special infilling shall be paid for separately.
- 18) The cost of the description of cores and samples shall be included in the rates for forming exploratory holes.

5.2 MEASUREMENT AND PAYMENT

The quantities set forth in the Bill of Quantities are estimated and may vary from the final approved quantities.

i) Mobilization and Demobilization

Payment for mobilization and demobilization will be made at the lump sum price for Mobilization and Demobilization, which price shall include furnishing the drilling rig(s) with all necessary equipment, materials, and labour. Payment will be made at the lump sum price under Bill A.

Thirty percent (30%) of the lump sum price will be paid when geophysical testing has begun. An additional thirty percent (30%) of the lump sum will be when drilling has started with all drilling rigs mobilized. Twenty percent (20%) of the lump sum will be paid when all equipment, unused material, and waste materials have been removed and all work at the site completed. The remaining twenty percent (20%) of the lump sum will be paid when all samples have been delivered to the permanent storage facility and all exploration records and final reports have been received and accepted by the Engineer.

ii) Set-Ups

Measurement for payment for set-ups at individual borings will be made at the unit price in the Bill of Quantities. Set-ups shall be deemed to be applicable to all locations and ground profile. The unit rate shall include the clearing and the levelling required for setting up at each drilling site including any access tracks, mats, planks or anchorage, or construction of a work pad; moving drilling equipment from one project area or boring to another. If however, two holes are drilled from the same general location and require only a slight repositioning of the drill rig or drill head, only one set-up will be paid.

iii) Overburden Drilling

Measurement for payment for drilling overburden will be based on the particular method of drilling used, as required, and the number of linear meters drilled and sampled using that method. Payment will be made at the appropriate unit price in Bill C (drilling without cores). In no case shall more than one type of drilling be charged for the same interval of hole depth. These prices shall include all equipment, materials and labour necessary to perform the particular drilling method, including record keeping and measurement of groundwater levels.

iv) SPT Sampling

Measurement for payment for Standard Penetration Test (SPT) sampling will be based on the number of tests performed as required. Payment will be made at the unit price in the Bill of Quantities, which

price shall include all equipment, materials, and labour necessary to perform the test, recover, and preserve the sample, including jars for the samples, storage containers, transporting samples and record keeping.

v) Shelby Tube Sampling (U100)

Measurement for payment for Shelby Tube Sampling (U100 thin walled samplers) will be based on the number of samples taken as required. Samples with less than 20 mm material recovered will not be measured for payment. Payment will be made at the unit price in the Bill of Quantities, which price shall include all equipment, materials, and labour necessary to take, recover, and preserve the sample, transporting samples and record keeping.

vi) Core Drilling

Measurement for payment for 'HQ' size coring will be based on the number of linear meters cored through bedrock or other materials. Payment will be made at the unit price in Bill C, which price shall include all equipment, labour, water and other fluids (including placing cement plugs, if necessary), core boxes, record keeping and other necessary items to core, recover, preserve and transport cores to the storage site. No separate payment will be made for preparation of driller's logs. This should be included in the price for drilling and other items.

vii) Permeability Testing

Measurement for payment for permeability testing will be based on the number of tests performed as instructed by the Engineer. Payment will be made at the unit price in Bill F, which price shall include equipment, labour, water, record keeping, and other items and work necessary to perform the test.

viii) Water Pressure (Lugeon) Testing

Measurement for payment for testing will be based on the number of actual recorded water pressure tests (Packer tests). Payment will be made at the unit price in Bill F, which price shall include all equipment, labour, water, record keeping, and other items and work necessary to perform the test. No payment will be made for time spent calibrating the equipment, friction loss tests, down time caused by equipment failure, or for time to repair such equipment.

ix) Point Load Testing

Measurement for payment for point load testing of rock samples will be based on the number of tests successfully performed. Payment for the point load testing shall be made at the unit price as described in Bill F upon receipt of completed test reports. Point load tests shall be performed in the field.

x) Piezometers

Measurement for payment for standpipe piezometers will be made based on the number of completed piezometers, which price shall include furnishing all materials, supplies, equipment, and labour for installing the piezometers as specified.

xi) Observation Trench Excavation

Measurement for payment for observation trench excavation will be based on the number of excavated trenches and collecting required samples and backfilling the test pit / trench when completed. Payment will be made at the unit price in Bill D, which price shall include all equipment, materials, and labour necessary to perform the excavation, temporary shoring, taking and preserving the samples, including jars, containers, and wrapping

xii) Backfilling of Borings

Measurement for payment for backfilling borings with grout will be based on the number of linear meters of backfill placed. Payment will be made at the unit price in Bill C, which price shall include the furnishing of all materials for the cement-bentonite grout and equipment and labour necessary to mix and place the grout into the hole, furnishing and placing the concrete location monument survey hub,

and record keeping. No payment shall be made for backfilling of borings for the lengths of boreholes in which piezometers are installed.

Payment for grouting of piezometers shall be included under Item G1.

xiii) Geophysical Surveys

Measurement for payment for geophysical surveying will be based on the number of linear meters of survey performed. Payment for the survey work, interpretations, and preparation of Phase 1 report and all relevant data files, plans, and sections shall be made at the unit price in the Schedule under Item I2. Payment for the interpretations, and preparation of Phase 2 report and preparing updated data files, shall be made at the lump sum price in the Schedule under Item I2.

xiv) Laboratory Testing

Measurement for payment for laboratory testing of soil and rock samples will be based on the number and types of tests successfully performed. Payment for the laboratory testing shall be made at the unit price in Bill H upon acceptance of completed certified laboratory test reports.

xv) Non-Payment Items

No separate payment will be made for the following items:

- Calibration of testing equipment, gages, meters, etc.
- Downtime due to weather conditions, or downtime when the Contractor's equipment is not fully operational, lack of repair parts or equipment, or lack of crew;
- Core boxes, sample jars, sample preservation and packaging materials;
- Transportation of samples to the Owner's designated storage facility;
- Disposal of drill cuttings and other waste materials and site restoration;
- Maintaining and preparing logs, records and reports;
- Consumable materials (fuels, drilling fluids, explosives, replacement parts, etc.).

The costs of these items, and all other items of work not specifically indicated on the Bill of Quantities, shall be included under Bill A, Item A11.

xvi) Schedule of Pay Items

Payment to the Contractor shall be based on actual quantities of work performed as approved or accepted by the Engineer and at the units of measurement and prices set forth in the Bill of Quantities.

BILL A

GENERAL ITEMS AND PROVISIONAL SUMS

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
A1	Provide, maintain and remove at the end of the fieldwork all temporary camps and facilities for the Contractor and Engineer's staff.	Sum	-		
A2	Establish on site all plant, equipment and services and remove at end of fieldwork.	Sum	-		
A3	Professional attendance on site.	Sum	-		
A4	Establish the location and elevation of the ground at each exploratory hole and geophysical survey lines.	Sum	-		
A5	Facilities for the Engineers	Sum	-		
A6	Vehicle for the Engineer including fuel etc.,	Sum	-		
A7	Deliver all core boxes and samples to the specified address within Mozambique	Sum	-		
A8	Allow for packaging, sealing, labelling and dispatching by air freight as specified, selected soil, rock and groundwater samples to an approved laboratory (outside of Mozambique) or laboratories for testing, including air freight charges, fees, dues, airport charges and agency handling but including delivery to airport freight depot (weight including packaging)	kg	1,500		
A9	One master copy of the Factual Report in pdf Format	Sum	-		
A10	One master copy of the Interpretative Report (for seismic refraction geophysical surveying only) in pdf Format.	Sum	-		
A11	Allow for every expense in complying with the Conditions of Contract the Additional General Conditions and the Specification.	Sum	-		
A12	Carryout geological mapping and prepare drawings in AutoCAD format.	ha	110		

A-1	PAGE TOTAL A-1, carried forward to summary	
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**BILL A
SUMMARY**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page A-1				
A-2	Total of BILL A Carried to Summary of Bills				

BILL B
BOREHOLES

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Not Used				

B-1	PAGE TOTAL B-1, carried forward to Grand Summary	
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BILL C

ROTARY DRILLING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Set-up				
C1	Move rotary drilling plant and equipment to the site of each exploratory hole and set up (rate to include setting up on slopes of gradient greater than 20%).	Nr	11		
	Drilling without cores				
C2	Rotary drill in at the specified diameter, from which cores are not required, between existing ground level and 10 m depth.	m	55		
C3	As Item C2 but between 10 m and 20 m depth.	m	Rate only		
C4	As Item C2 but between 20 m and 30 m depth	m	Rate only		
C5	As Item C2 but between 30 m and 40 m depth	m	Rate only		
	Drilling to obtain cores				
C6	Rotary drill in hard strata to obtain cores of the specified diameter between existing ground level and 10 m depth.	m	55		
C7	As Item C6 but between 10 m and 20 m depth.	m	110		
C8	As Item C6 but between 20 m and 30 m depth.	m	110		
C9	As Item C6 but between 30 m and 40 m depth.	m	95		
C10	As Item C6 but between 40 m and 50 m depth.	m	60		
C11	As Item C6 but between 50 m and 60 m depth.	m	60		
C12	As Item C6 but between 60 m and 70 m depth.	m	60		
C13	As Item C6 but between 70 m and 80 m depth.	m	30		
C14	Extra over items C2 to C13 for coring inclined drillhole	m	80		

C-1	PAGE TOTAL C-1, carried forward to summary	
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BILL C

ROTARY DRILLING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	General				
C15	Backfill drillholes with cement/bentonite grout.	m	80		
C16	Core box to be retained by Client	Nr	125		

C-2	PAGE TOTAL C-1, carried forward to summary			

BILL C

SUMMARY

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page C-1				
2.	Total of Page C-2				

C-2	Total of BILL C Carried to Summary of Bills			

BILL D

PITS AND TRENCHES

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Observation pits and trenches				
D1	Move equipment to the site of each observation pit or trench	Nr	8		
D2	Excavate observation pit (6 m long x 1 m wide) between existing ground level and 3.0 m depth.	m	24		
D3	As Item D13 but between 3.0 m and 4.5 m depth	m	12		
D4	Maintain all excavations free from water.	Sum	1		

D-1	PAGE TOTAL D-1, carried forward to summary				

**BILL D
SUMMARY**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page D-1				

D-2	Total of BILL D Carried to Summary of Bills				

**BILL E
SAMPLING**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
E1	Small disturbed sample (1 kg)	Nr	80		
E2	Large bulk disturbed sample (50 kg)	Nr	50		
E3	Open tube sample (U100)	Nr	30		
E4	Groundwater sample	Nr	10		
E5	Core sub sample	Nr	200		
E6	River water sample	Nr	3		

E-1	PAGE TOTAL E-1, carried forward to summary				

**BILL E
SUMMARY**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page E-1				

E-2	Total of BILL E Carried to Summary of Bills				

BILL F
IN SITU TESTING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Tests in Boreholes				
F1	Standard penetration test in borehole	Nr	30		
	Permeability testing				
F2	Set up and dismantle variable falling head permeability test in borehole	Nr	10		
F3	Carry out permeability test in borehole	Nr	10		
F4	Set up and dismantle packer permeability test	Nr	75		
F5	Carry out packer permeability test	Nr	75		
	Point Load Tests				
F6	Determination of point load strength of rock specimen in the field	Nr	100		
	Chemical and electro-Chemical Tests				
F7	On site testing of groundwater samples and river water samples using a portable hand held readout unit for pH, turbidity, dissolved oxygen, electrical conductivity, temperature and redox	Nr	8		

F-1	PAGE TOTAL F-1, carried forward to summary				

BILL F

SUMMARY

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page F-1				

F-2	Total of BILL F Carried to Summary of Bills				

BILL G

INSTRUMENTATION AND MONITORING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
Standpipes and Piezometers					
G1	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer.	m	80		
G2	Standpipe piezometer.	m	370		
G3	Protective cover (raised).	Nr	5		
G4	Reading of water level in standpipe, or standpipe piezometer during fieldwork period (<i>Contractor</i> to provide dip-meter, up to 100 m long).	Nr	40		
G-1	PAGE TOTAL G-1, carried forward to summary				

**BILL G
SUMMARY**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page G-1				
G-2	Total of BILL G				

	Carried to Summary of Bills	
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BILL H

LABORATORY TESTING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Classification				
H1	Moisture content	Nr	15		
H2	Liquid limit, plastic limit and plasticity index	Nr	15		
H3	Particle size distribution by wet sieving	Nr	20		
H4	Sedimentation by hydrometer	Nr	20		
	Chemical and Electrochemical	Nr			
H5	Organic matter content	Nr	5		
H6	Sulphate content of acid extract from soil	Nr	5		
H7	Sulphate content of water extract from soil	Nr	5		
H8	Sulphate content of groundwater	Nr	5		
H9	Water soluble chloride content	Nr	5		
H10	Acid soluble chloride content	Nr	5		
H11	Sulphide content	Nr	5		
H12	pH value	Nr	5		
	Compaction related				
H13	Dry density/moisture content relationship using 2.5 kg rammer	Nr	8		
	Rock testing				
H14	Natural water content of rock sample	Nr	20		
H15	Porosity/density using saturation and calliper techniques	Nr	20		
H16	Slake durability index	Nr	5		
H18	Aggregate crushing value	Nr	8		
H19	Ten percent fines	Nr	8		
H20	Aggregate impact value	Nr	8		
H21	Aggregate abrasion value	Nr	8		

H-1	PAGE TOTAL H-1, carried forward to summary				

BILL H

LABORATORY TESTING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
H22	Uniaxial compressive strength	Nr	50		
H23	Young's modulus and Poisson's Ratio	Nr	15		
H24	Indirect tensile strength by Brazilian test	Nr	15		
H25	Undrained triaxial compression with measurement of porewater pressure	Nr	10		
H26	Direct shear strength of a single specimen	Nr	10		
AAR Tests on Aggregates					
H28	Petrographic Examination of aggregates (ASTM C295)	Nr	6		
H29	Potential AAR (Mortar-Bar Method) (ASTM C1260)	Nr	6		
H30	Length of Change of Concrete due to ASR (ASTM C1293)	Nr	6		

H-2	PAGE TOTAL H-2, carried forward to summary				

**BILL H
SUMMARY**

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page H-1				
2.	Total of Page H-2				

H-3	Total of BILL H				
	Carried to Summary of Bills				

BILL I

GEOPHYSICAL SURVEYING

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD\$
	Seismic Refraction Surveys				
I1	Clear seismic refraction geophysical survey lines.	m	5,500		
I2	Carry out seismic refraction geophysical surveying along survey lines, including provision of experienced geophysicist and all necessary equipment to allow interpretation in the field, transport, labour etc.	m	5,500		
	Orientated Optical Televiewer Logging (OPTIONAL ITEM)				
I3	Set up and dismantle Optical borehole televiewer equipment at the location of each borehole (Dam Site only).	Nr	7		
I4	Carryout orientated optical televiewer survey through full depth of borehole, including interpretative report, joint surveys etc. (Dam Site only)	m	450		

I-1	PAGE TOTAL I-1, carried forward to summary	
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BILL I

SUMMARY

Item	Item Description	Unit	Quantity	Rate USD \$	Amount USD \$
1.	Total of Page I-1				

I-1	Total of BILL I Carried to Summary of Bills	
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GRAND SUMMARY OF BILLS OF QUANTITIES

Bill	USD \$	c
A. General Items & Provisional Sums		
B. Boreholes	Not used	-
C. Rotary Drilling		
D. Pits and Trenches		
E. Sampling		
F. In Situ Testing		
G. Instrumentation and Monitoring		
H. Laboratory Testing		
I. Geophysical Surveying		
Total of Tender		
Withholding tax (or any other Tax liability)		

Tender Sum in Words

.....

.....

.....

Tenderer's Signature

6. DOCUMENTS NOT FORMING PART OF THE CONTRACT

6.1 CHECKLIST FOR RETURN OF TENDERS

Within Tender Document:

- Form of Tender
- Form of Tender - Appendix Part 2
- Bill of Quantities
- Rates For Geotechnical & Other Personnel
- Tenderer's Data
- List of Personnel
- List of Laboratories
- Health & Safety Questionnaire

Separate to Tender Document:

- Programme
- Track record and experience of similar investigations for major dams in southern Africa
- CVs of key personnel
- Method Statement
- Outline description of geophysical and borehole televiwer investigations
- Copy of Health & Safety Policy
- Evidence of Insurances

6.2 TENDERER'S DATA

(To be completed by all Tenderers at time of Tendering)

Full Name of Firm Tendering

Address for Correspondence

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.....

.....

Zip code / PO Box

Tenderer's Reference

Name of Person Dealing with Tender

Telephone number

Extension

Fax number

E-Mail Address

Name of the Bankers of the Tenderer

Address of the Bankers of the Tenderer

.....

.....

.....

Post code

Telephone number

Fax number

Tenderer's Bank Account No.

6.3 TENDER SCHEDULES

List of Personnel

The Tenderer shall list below details of personnel the Tenderer proposes to employ in carrying out the Investigation as required by the specification. Names of personnel and their function either on or off site shall be described, together with details of their relevant qualifications and experience.

Name of Personnel	Details and Experience

Signed

Date

Name

Position

Tenderer

List of Laboratories

The Tenderer shall list below the name and address and details of each laboratory, including any owned by the Tenderer, which the Tenderer proposes to use for any of the laboratory testing. Where laboratories are not accredited for any test, the details of quality assurance shall demonstrate that standards equivalent to accreditation requirements will be met. The Tenderer’s attention is drawn to Clauses 3 and 4 of the Conditions of Contract.

Name and address of laboratory	Equipment available	No of laboratory staff	Tests to be performed	Accreditation status for each test

Signed

Date

Name

Position

Tenderer

H&S QUESTIONNAIRE

(To be completed by all Tenderers at time of Tendering)

[This information is for tender evaluation purposes and will not form part of the Contract]

PART A – GENERAL

- 1 Please give the date of issue or date of latest amendment to your Company’s Health & Safety Manual

- 2 Please submit a copy of your Company’s Health & Safety Manual.

- 3 Who has overall responsibility for Health and Safety in your Company?
 Name:
 Qualifications:
 Position:
 Reporting to:

- 4 Who will be nominated to provide specific Health and Safety advice for this Contract?
 Name:
 Qualifications:
 Position:
 Reporting to:

- 5 How frequently do you audit your Health & Safety performance?

- 6 How many injuries, diseases and dangerous occurrences have you reported to the HSE in the last three years?

Year	Incident Rate*
.....
.....
.....

 - * Expressed as incidents per 100,000 employees

- 7 What procedures will you follow for selecting and controlling sub-Contractors with respect to Health & Safety?

PART B - SITE OPERATIONS

- 8 What procedures will you adopt to deal with the hazards identified in tender document?
- 9 What further hazards do you anticipate may be present during the execution of this contract?
- 10 How will you deal with the hazards identified in (9) above and any others that may arise during the contract?
- 11 What procedures will be implemented to exclude unauthorised persons (especially children) from the site?
- 12 How will you ensure the Health & Safety of visitors to the site?
- 13 How will Health & Safety information and instructions be communicated to
 - (a) Your employees?
 - (b) Sub-Contractors?
 - (c) Employees of the Employer?
 - (d) The Engineer and his staff?
 - (e) The Engineer's Representative and his staff?
- 14 How will you inform others (other Contractors, the general public), working in the vicinity of the Site, of Health & Safety hazards arising during the execution of the Contract?
- 15 How will you liaise with, and maintain communications with, others regarding Health & Safety hazards arising during the execution of the Contract?
- 16 How will you control or reduce
 - a) Noise?
 - b) Vibration?
 - c) Pollution?
- 17 What are your proposed methods of fire prevention?
- 18 What are your proposed emergency procedures?
- 19 How will you manage and control visits during the construction phase?
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.....
- 20 What welfare facilities do you proposed to establish on site?

PART C - RESOURCES

- 21 List principal resources that will be on site for use in emergencies
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.....
.....
.....

Signed

Date

Name

Position

Tenderer

APPENDIX A DRAWINGS