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**National Housing Development Corporation Limited**



Royal Government of Bhutan  
Kingdom of Bhutan

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# REQUEST FOR QUOTATION NON-CONSULTING SERVICES

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For the

## GEOPHYSICAL TESTS AND CORE DRILLING FOR THE PROPOSED HOUSING COLONY AT RINCHENDING

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Green and Resilient Affordable Housing Development  
Sector Project:

ADB Project No: 54355-001



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Date Issued: 7<sup>th</sup> May 2022

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# REQUEST FOR QUOTATION - SERVICES (RFQS)

Project Title	Green & Affordable Housing Development Sector Project, Project Number: 54355-001
Source of Funding:	ADB
Contract Title:	Geophysical Tests and Core Drilling for the Proposed Housing Colony at Rinchending
Contract Ref	D&PS/CAU-12/2022
Date of Issue of Request:	07/05/2022

To: **Geotechnical Consultancy Firms**

Sir/Madam:

1. The **National Housing Development Corporation Ltd.** (Client) hereby requests you to submit price quotation/(s) for the performance of the services described in the [Scope of Services](#) attached as [Appendix A](#) in these documents. If you, however, have been associated with the preparation of this **Scope of Services** that is the subject of this request, you shall be disqualified.

To assist you in the preparation of your price quotation we enclose, in addition to the [Scope of Services](#), the [Form of Quotation](#) and form of **Contract** are also attached.

2. If you/your firm, however, falls under any of the following conditions, your proposal shall not be considered:
  - (a) you/your firm are/is not a citizen/national of an ADB member country (<https://www.adb.org/countries/main>), or
  - (b) you/your firm have/has been associated with the firm that prepared the terms of reference or engaged in the preparation of the Project for which the contract that is subject of this request for quotations was identified, or
  - (c) you/your firm are/is owned by the Client, or
  - (d) you/your firm are/is currently sanctioned or temporarily suspended by the Asian Development Bank for a violation of its [Anticorruption Policy](#) (1998, as amended to date) or
  - (e) the contracting of services from your country or any payment to persons or entities in your country is prohibited in compliance with a decision of the United Nations Security Council under Chapter VII of the Charter of the United Nations.
3. To be qualified, you must have experience as a [Service Provider](#) of the services covered by this **Request for Quotation**. As evidence, you must attach a document of your experience as Service

Provider in at least **two contracts** in the **last 3 years** of a nature similar to the requirements of this contract.

4. Your quotation/(s) should be submitted in accordance with the following instructions, procedures, and the terms and conditions of the **Contract**.

#### **Preparation of Quotations**

- (a) Your price quotation/(s) shall be for all the items as described in the **Scope of Services in the TOR, and** submitted only in the attached **Form of Quotation**. The currency of quoted prices and payment shall be **Ngultrum**.
- (b) You shall submit only one set of quotations for the above items. Your quotation must be typed or written in indelible ink and shall be signed by you or your authorized representative. Without a signature in your **Form of Quotation**, your quotation will not be considered further.
- (c) You shall submit one original of the **Form of Quotation**, and clearly marked "Original". In addition, you shall also submit one copy marked as "COPY". In case of any discrepancy between the Original and Copy, the Original shall prevail.
- (d) Your quotation should be valid for a period of **30 days** from the deadline for submission of the quotation as indicated below. If you withdraw your quotation during the validity period and/or refuse to accept the award of a contract when and if awarded, then you will be excluded from the list of Service Providers for the project for two years.

#### **Submission and Opening**

- (e) Your **Form of Quotation** should be **submitted by 18<sup>th</sup> May 2022 not later than 1.00 PM** with the required documents that should be signed, sealed in an envelope and addressed to and delivered to the following address:

Attention:	<b>Chief Executive Officer</b>
Client's Address:	<b>National Housing Development Corporation Ltd. Thimphu.</b>
Telephone	<b>00975-2-323147 / 332734 / 332735</b>
Email Address:	<b>sonamchoden@nhdcl.bt</b>

- (f) Quotations shall be **opened** in public, in the presence of participating Service Providers' representatives who choose to attend on **18<sup>th</sup> May, 2022 at 2.00 PM** and at the following address. NHDCL Conference Hall, Thimphu.

#### **Evaluation and Comparison**

- (g) Quotations determined to be substantially responsive to this **Request for Quotation** will be evaluated by comparison of their offer prices. A quotation is not substantially responsive if it contains material deviations or reservations to the TOR and specifications in this **Request for**

**Quotation including the Conditions of Responsiveness.**

- (h) In evaluating the quotations, the Client will adjust for any arithmetical errors as follows:
- (i) where there is a discrepancy between amounts in figures and in words, the amount in words will govern; and
  - (ii) where there is a discrepancy between the unit rate (where applicable) and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern; and if you refuse to accept the correction/(s), your quotation will be rejected.

**Award of Contract**

- (i) The Client shall award the contract to the Service Provider whose quotation has been determined to be substantially responsive to this Request for Quotation and who has offered the lowest price quotation.
  - (j) The Service Provider whose quotation has been accepted will be notified by the Client within **Five (5) days** from the date of submission of quotation through the return of a copy of the **Form of Quotation with Acceptance** signed by the authorized representative of the Client.
5. The successful Service Provider shall sign the **Contract** governed by the annexed **Contract Terms and Conditions**. Further information can be obtained from:
- Name: **Thinley Wangdi / Chimi**  
Address: **NHDCL, Thimphu.**  
Fax: **00975-2-331703**  
E-mail: [thinley.wangdi@nhdcl.bt](mailto:thinley.wangdi@nhdcl.bt) / [chimi@nhdcl.bt](mailto:chimi@nhdcl.bt)
6. The Client intends to apply funds from the **Asian Development Bank (ADB)** for eligible payments under the **Contract** resulting from this **Request for Quotation**.
7. Under [ADB's Anticorruption Policy](#) (1998, as amended to date) Service Providers shall observe the highest standard of ethics during the procurement and execution of such contracts. ADB may reject a proposal for award, and may impose sanctions or other remedial actions on parties involved, if it determines that the Service Provider recommended for award or any other party, directly or through an agent, has engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for, or in executing, the Contract. At the time of submission of your quotation, you should not be in ADB's sanctions list. A firm/individual shall not be eligible to participate in any procurement activities under an ADB-financed, -administered, or -supported project while under temporary suspension or debarment by ADB pursuant to its Anticorruption Policy, whether such debarment was directly imposed by ADB, or enforced by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions.
8. You/your firm, joint venture partners, associates, parent company, affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, are not, or have never been, temporarily suspended, debarred, declared ineligible, or blacklisted by the client's country, any international organization, and other donor agency.

If so debarred, declared ineligible, temporarily suspended, or blacklisted, please state details (as applicable to each joint venture partner, associate, parent company, affiliate, subsidiaries, subcontractors, and/or suppliers):<sup>1</sup>

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<sup>1</sup> Any such disclosure shall be forwarded by the Client to ADB.

(a) Name of Institution: \_\_\_\_\_

(b) Period of debarment, ineligibility, or blacklisting (start and end date): \_\_\_\_\_

(c) Reason for the debarment, ineligibility, or blacklisting: \_\_\_\_\_

9. You/your firms, joint venture partners', associates', parent company's affiliates or subsidiaries', including any subcontractors' or suppliers', key officers and directors have not been [charged or convicted] of any criminal offense (including felonies and misdemeanors) or infractions/violations of ordinance which carry the penalty of imprisonment.

If so charged or convicted, please state details:<sup>2</sup>

(a) Nature of the offense/violation: \_\_\_\_\_

(b) Court/Area of jurisdiction: \_\_\_\_\_

(c) Resolution (i.e. dismissed; settled; convicted/duration of penalty): \_\_\_\_\_

(d) Other relevant details:

10. You/your firm understands that it is your obligation to notify ADB should you/your firm, joint venture partners, associates, parent company, affiliates or subsidiaries, including any Subcontractors or Suppliers, be temporarily suspended, debarred or become ineligible to work with ADB or any other multilateral development banks, the client's country, international organizations, and other donor agencies, or any of your key officers and directors be charged or convicted of any criminal offense or infractions/violations of ordinance which carry the penalty of imprisonment.
11. Any misrepresentation that knowingly or recklessly misleads, or attempts to mislead may lead to the automatic rejection of the quotation/bid or cancellation of the contract, if awarded, and may result in remedial actions, in accordance with ADB's Anticorruption Policy (1998, as amended to date) and Integrity Principles and Guidelines (2015 as amended from time to time).
12. A bidder shall not have a conflict of interest. All bidders found to have a conflict of interest shall be disqualified.
13. Please confirm by fax/e-mail the receipt of this request and whether or not you will submit the price quotation(s).

Sincerely,

**Chief Executive Officer**  
**NHDCL, Thimphu**

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<sup>2</sup> Any such disclosure shall be forwarded by the Client to ADB.

# FORM OF QUOTATION (Services)

\_\_\_\_\_ [date]

To: \_\_\_\_\_ [Client's Name]

\_\_\_\_\_ [Client's Address]

\_\_\_\_\_

We offer to execute the \_\_\_\_\_ [name and number of Contract] in accordance with the **Contract Terms and Conditions, Scope of Services** and the **Conditions of Responsiveness** accompanying this Quotation for the Contract Price not to exceed

\_\_\_\_\_ [amount in words and numbers] ( \_\_\_\_\_ ) [name of currency] \_\_\_\_\_ in accordance with **Price Schedule** annexed to the **Scope of Services**.

**Note: Attach a Price Schedule form to the Scope of Services.**

We propose to complete the performance of the services described in the **Contract** within the Completion Period indicated in the priced **Scope of Services**.

This Quotation and your written acceptance will constitute a binding Contract between us. We understand that you are not bound to accept the lowest or any Quotation you receive.

We hereby confirm that this Quotation complies with the Validity of the Offer condition imposed by the **Request for Quotation** document.

We: (a) are a national of an ADB member country; (b) have not been associated with the firm that prepared the terms of reference or engaged in the preparation of the Project for which the contract that is subject of this request for quotations was identified; (c) are not owned by the Client; (d) are not currently sanctioned or temporarily suspended by the Asian Development Bank; and (e) to the best of our knowledge, is not prohibited from being contracted in compliance with a decision of the United Nations Security Council.

Name of Service Provider: \_\_\_\_\_

Authorized Signature : \_\_\_\_\_

Name of Signatory : \_\_\_\_\_



Title of Signatory : \_\_\_\_\_

Address : \_\_\_\_\_

Telephone Number : \_\_\_\_\_

Fax Number, if any : \_\_\_\_\_

Email address (optional) : \_\_\_\_\_

# ACCEPTANCE

**The Client accepts the Service Provider's offer to provide the service.**

Name of Client: \_\_\_\_\_

Authorized Signature: \_\_\_\_\_

Name of Signatory: \_\_\_\_\_

Title of Signatory: \_\_\_\_\_

Date: \_\_\_\_\_

# PRICE SCHEDULE

Sl. No.	Description of Activities	Unit	Qty	Rate	Amount
<b>A</b>	<b>FIELD TESTS:</b>				
<b>Geophysical Survey:</b>					
1	<b>Seismic Refraction Test</b> (Each profile of 115m length).	Mtr	575		
2	<b>Electrical Resistivity Test</b> (Each profile of 295m length).	Mtr	1475		
3	<b>Core Drilling &amp; Backfilling</b> the hole with Grout /Concrete. 4-boreholes of varying depth from 15, 20, 30 and 50m based on <b>the site conditions</b>	Mtr	115		
4	4 SPTs in each borehole.	Nos	16		
5	Constant Head Test ( <b>CHT</b> ) in Boreholes for testing <b>Soil Permeability.</b>	Nos	15		
6	<b>Packer Test</b> in Boreholes for testing <b>Rock Permeability.</b>	Nos	10		
<b>B</b>	<b>LABORATORY TESTS:</b>				
7	Geotechnical Lab Test for <b>Soil Core Samples</b> (Sieve Analysis, Bulk Density, Dry Density, Specific Gravity, Plastic & Liquid Limit, Consolidation & Direct Shear, and Proctor Compaction Test).	Nos	16		

Sl. No.	Description of Activities	Unit	Qty	Rate	Amount
8	Geotechnical Lab Test for <b>Rock Core Sample</b> - Unconfined Compression Tests (UCS)	Nos	10		
<b>C</b>	<b>DESK WORK:</b>				
10	Preparation of <b>Report(s)</b> ; including data interpretation and analysis, data processing and mappings and model generation printing documents and submission etc. covering all others, to complete the required deliverables including presentation to the Client.		Lumpsum		
11	Study, analysis, calculation works & preparation of reports on Slope stability Analysis based on core drilling results.		Lumpsum		
	<b>Experts' HOME OFFICE INPUT (in man-day) required for DESKWORK</b>				
a)	Team Leader (Geotechnical Expert):	day	Lumpsum		
b)	Drilling Supervisor and Technicians	day	Lumpsum		
c)	Geophysical Surveyors / Technicians	day	Lumpsum		
d)	GIS Expert: (in case if the inputs of GIS Expert are required as per the proposal of the firm.)	day	Lumpsum		
<b>D</b>	<b>OTHER COSTS INVOLVED IN THIS PROJECT:</b>				

Sl. No.	Description of Activities	Unit	Qty	Rate	Amount
a)	<p><b>Mobilization / Field Office Management:</b> This includes <b>all costs</b> associated with field transportations / hiring of vehicle(s) for field staff, hiring of field equipment, rental charges for apartment(s) in the field etc. required to carry-out field activities.</p>		Lumpsum		
b)	<p><b>Home Office Management:</b> This includes <b>all costs</b> for the home office expenses, such as rentals, support staff, office manager, telephones, internet charges, local transportation etc. required to carry-out home office activities.</p>		Lumpsum		
				<b>Total</b>	

# DOCUMENTARY EVIDENCE AS A SERVICE PROVIDER

- **Refer Conditions of Responsiveness in TOR clause 8.**

# CONTRACT

Name of Country: Bhutan

Project Name: Green and Resilient Affordable Housing Sector Project

Name of Contract	
Contract Number	

This Contract is entered into on \_\_\_\_\_[date]\_\_\_\_ day of \_[month]\_,\_ [year]\_\_\_\_, between \_\_\_\_\_[name of Client]\_\_\_\_\_ (hereinafter called "the Client") on the one part, and \_\_\_\_\_[name of Service Provider]\_\_\_\_\_ (hereinafter called "the Service Provider") on the other part.

Whereas the Client has requested a quotation for \_\_\_\_\_[description of services] to be performed by the Service Provider in accordance with the **Contract**, and has accepted the Quotation by the Service Provider in the amount of \_\_\_\_\_[amount in words]\_\_\_\_ [amount in figures] hereinafter called "the Contract Price".

The Client and the Service Provider agree as follows:

1. The following documents shall be deemed to form and be read and construed as part of this Contract, viz:
  - a) **Form of Quotation**, with **Scope of Services** and **Appendix [and Price Schedule under Option B form of quotation]**; and
  - b) **Contract Terms and Conditions**;
2. Taking into account payments to be made by the Client to the Service Provider as hereinafter mentioned, the Service Provider hereby enters into this Agreement with the Client to execute and complete the performance of services under the Contract.
3. The Client hereby agrees to pay, in consideration of the successful performance of the services, the **Contract Price** as indicated and accepted in the **Form of Quotation**, under payment terms stipulated in the **Contract Terms and Conditions**.

IN WITNESS whereof the parties hereto have executed the **Contract** under the laws of \_\_\_\_\_ [country of Client] on the date indicated above.

<b>Signature and seal of the Client:</b> For and on behalf of  _____ Name of Authorized Representative	<b>Signature and seal of the Service Provider:</b> For and on behalf of  _____ Name of Authorized Representative
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# CONTRACT TERMS AND CONDITIONS

Name of Contract	
Contract Number	
Client	

## 1. Definitions

- (a) "Contract" means the agreement entered into between the Client and the Service Provider, together with the Contract Documents referred to therein, including all attachments, appendixes, and all documents incorporated by reference therein.
- (b) "Contract Documents" means the documents listed in the Contract, including any amendments thereto.
- (c) "Contract Price" means the price payable to the Service Provider as specified in the Contract, subject to such additions and adjustments thereto pursuant to the Contract.
- (d) "Completion" means the fulfilment of the committed services by the Service Provider in accordance with the terms and conditions set forth in the Contract.
- (e) "Client" means the entity purchasing the Services.
- (f) "Services" means the services the Service Provider will perform as specified in the Scope of Services in Appendix A.
- (g) "Service Provider" means the natural person, private or government entity, or a combination of the above, whose bid to perform the Contract has been accepted by the Client and is named as such in the Contract.
- (h) "ADB" is the Asian Development Bank.

## 2. Applicable Law

The Contract shall be interpreted in accordance with the laws of the Client's country.

## 3. Language

All communications and documents related to the Contract shall be in English.

## 4. Assignment

Any assignment of this Contract or of any rights hereunder, in whole or in part without the prior written consent of the Client shall be void.

## 5. Fraud and Corruption

This Contract shall be covered by the provisions of [ADB's Anticorruption Policy](#) (1998, as amended to date) and [Integrity Principles and Guidelines](#) (2015, as amended from time to time) that requires Borrowers (including beneficiaries of ADB-financed activity), as well as Service Providers and Contractors under ADB-financed contracts, to observe the highest standard of ethics during the procurement and execution of such contracts.

## 6. Performance of the Services



The Service Provider shall carry out the Services with due diligence and efficiency and shall furnish to the Client such information related to the Services as the Client may from time to time reasonably request. The Service Provider shall at all times cooperate and coordinate with the Client with respect to the performance of the Services.

## **7. Required Performance Standards (with attachments as necessary to be prescribed by Client.)**

- (a) General Description
- (b) Specific Standards
- (c) Performance Parameters

Service Provider confirms compliance with above standards and parameters.

## **8. Service Completion Schedule**

The services should be completed as per schedule indicated in the **Scope of Services** but not exceeding 2 months (60 days).

If the **firm fails** to complete the whole of the work/services, **or** any part thereof within the time agreed upon for completion **or** on the expiry of contract, the **client** shall have the right to levy liquidated damages equivalent to **0.1 percent** of the contract price **for every day** delay subject to a **maximum of 10%** of the total contract price.

## **9. Fixed Contract Price**

The prices indicated in the **Form of Quotation** are firm and fixed and not subject to any adjustment during contract performance, subject to Clause 11 [Payment] below.

## **10. Taxes and Duties**

The Service Provider shall be entirely responsible for all taxes, duties, license fees, etc., incurred until completion of the services to the Client.

## **11. Payment**

Upon submission by Service Provider of claim and subsequent verification of the claim by Client, payment of the contract price shall be made in the following manner:

- (a) **Twenty percent (20%) of the contract amount shall be paid upon submission of the inception report within 7 days as per TOR.**
  
- (b) **Eighty percent (80%) payment shall be paid upon the certification by the Client on the successful completion of services.**

## **12. Resolution of Disputes**

The Client and the Service Provider shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute between them under or in connection with the Contract. In the case of an unresolved dispute, the dispute shall be settled in accordance with the provisions of the Bhutan Alternative Dispute Resolution Centre (BADRC);

All disputes arising in connection with the present Contract shall be for finally resolved by arbitration in accordance with the rules and procedures of the Bhutan Alternative Dispute Resolution Centre (BADRC). The arbitration award shall be final on the parties who shall be deemed to have accepted to carry out the resulting award without delay and to have waived their right to any form of appeal insofar as such waiver can validly be made.

## **13. Independent Service Provider**

Nothing contained in this Contract shall be construed as establishing or creating the relationship of master and servant, employer and employee or principal and agent between the Client and the Service Provider, or his employees or agents or other persons engaged by the Service Provider to perform any of the services.

## **14. Intellectual Property Rights**

Intellectual Property Rights: (a) The Service Provider shall indemnify the Client from and against any and all claims, liabilities, obligations, losses, damages, penalties, actions, judgments, suits, proceedings, demands, costs, expenses and disbursements of whatsoever nature that may be imposed on, incurred by or asserted against, the Client during or in connection with the Services by reason of: (i) infringement or alleged infringement by the Service provider of any patent or other protected right, or (ii) plagiarism or alleged plagiarism by the Service provider.

## **15. Failure to Perform**

The Client may terminate the Contract if the Service Provider fails to perform the services, in accordance with the above terms and conditions, in spite of a 14-day notice given by the Client, without incurring any liability to the Service Provider. In the event of such termination, the amount due under the Contract shall be subject to equitable adjustment.

## **16. Termination Due to Integrity Violation**

The Client may terminate this Contract, in whole or in part, if the Service Provider, in the judgment of the Client has engaged in integrity violations in accordance with Clause 5 [Fraud and Corruption], in competing for or in executing this Contract.

## **17. Other Grounds for Termination**

The Client may also terminate this Contract, in whole or in part, if the Service Provider becomes insolvent, bankrupt or gives the Client reasonable evidence of its inability to complete the Services as specified, or fails to correct any non-conformity in the Services or performs in bad faith by willfully not observing the terms and conditions of this Contract.

## **18. Force Majeure**

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

- (a) For purposes of this Clause, "Force Majeure" means an events beyond the control of the Service Provider and not involving the Service Provider's fault or negligence and not foreseeable. Such events may include, but not restricted to, act of Client in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.
- (b) If a Force Majeure situation arises, the Service Provider shall promptly notify the Client in writing of such condition and the cause thereof. Unless otherwise directed by the Client in writing, the Service Provider shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by Force Majeure event.

## **19. Accounts and Records**

- (a) The Service Provider shall keep accurate and systematic accounts and records in respect of the Services in such form and detail as are customary in its profession and are sufficient to establish accurately that
- (b) the costs have been duly incurred.
- (c) Notwithstanding anything to the contrary stated herein, the Service Provider shall maintain accounts and records, including original receipts, invoices and other supporting documents evidencing payments made by the Service Provider under this Contract, for the period of the Services and for a period no less than 3 years after the expiration or termination of this Contract.
- (d) The Service Provider shall permit ADB to inspect the accounts, records, and other documents relating to the submission of bids and contract performance of the Service Provider and to have them audited by auditors appointed by ADB.

## **20. Suspension of ADB Loan or Credit.**

In the event that ADB suspends the Loan or Credit to the Client, from which part of the payments to the Service Provider are being made, the Client is obligated to notify the Service Provider, with copy to the Client's representative, of such suspension within 7 days of having received ADB's suspension notice.

## **21. Termination Notice Due to Non-payment**

If the Service Provider has not received payments due within the 28 days as provided for in Clause 11 [Payment], the Service Provid  
er may immediately issue a 14-day termination notice.

# APPENDIX A

## SCOPE OF SERVICES

- **Refer Scope of Services as prescribed in the Terms of Reference clause 3.**

# TERMS OF REFERENCE

## PROCUREMENT OF CONSULTING SERVICES



**Royal Government of Bhutan**  
**NATIONAL HOUSING DEVELOPMENT CORPORATION LIMITED**

**PROJECT NAME / TITLE OF CONSULTING SERVICE**

**GEOTECHNICAL SERVICE:  
GEOPHYSICAL TESTS AND CORE DRILLING**

**FOR**

**THE PROPOSED HOUSING COLONY AT  
RINCHENDING, PHUENTSHOLING**

**PROCURING AGENCY**



**National Housing Development Corporation Limited (NHDCL)**

**[ May 2022 ]**

# TERMS OF REFERENCE

## 1. Background:

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**Rinchending** is about 4 km away from Phuentsholing town and NHDCL proposes to construct green and resilient housing units through ADB funding to address the current challenges of housing shortage to the low-income bracket of civil servants, corporate and private sectors and also ease on congestion and stress on the existing infrastructure. The infrastructures that would be developed includes road network, water supply, sewerage, collection and treatment, power, telecommunication and flood warning system.

NHDCL has hired a geotechnical consulting firm and conducted geotechnical investigations as part of feasibility study to assess the risks of geological and other hazards in the proposed construction site. The investigation report revealed that, the proposed area lies on the old landslide deposits which formed as hummock (remnant mound of an old landslide) and about half of the site is a former sag pound. There are also several spring water-bodies nearby. Spring lines indicated the existence of local faults, and was evident from the highly fractures/powdered phyllites and quartzites rock outcrops resulted due to faulting. As per the findings of this investigation, the proposed site is fragile and highly susceptible to landslides due to which, there's risk of activating the landslide by the construction activities. It also stated that, the ground is composed of soil cover with weak underlying geological conditions.

Since the initial geotechnical investigation was mainly based on surface investigation by geological mappings, geotechnical laboratory tests and the subsurface explorations- limited to about 2-meter depth by trial pits and SPTs, the geotechnical firm recommended further subsurface explorations to confirm its findings as described below.

- Geophysical survey (Seismic Refraction Test and Electrical Resistivity Test)
- Core drilling (at least up to 50m depth)
- Standard Penetration Tests (Varying depth in the bore holes)

From these explorations, it is expected to understand the various lithologies with varying depths, landslide slip surface (failure plane) and depth to groundwater level which are the prime factors to determine the suitability of proposed housing project.

After reviewing the report, ADB in collaboration with the NHDCL now intend to carry out the detail subsurface explorations as recommended by the consultancy firm. Therefore, the proposals are invited from the competent and interested national geotechnical firms.

The **total area** identified for this **geotechnical service** is about **6.15 acres**.

Refer **Annex-I: Site Location Map** in the attachment

It is to be noted that, the findings of this investigation must contain factual information. All technical details- exploratory discoveries, mitigations and recommendations must be well documented and supported with rational analysis founded on site-specific data. .

## 2. Objective:

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**The objectives of this assignment are to** - conduct subsurface investigations and provide adequate information on the geological conditions of a substratum, assess the potential adverse impacts of the proposed housing project and provide appropriate recommendations and mitigation measures to be adopted. Specific investigations shall be:

1) **Seismic Refraction Test (SRT):**

- To assess and estimate subsurface layers- rock and soil units to characterize the geologic conditions, the depths to strata boundaries, water tables and /or the upper bedrock surface.

2) **Electrical Resistivity Test / Tomography (ERT):**

- To determine the depth of bedrock / overburden thickness; to assess the porosity, groundwater / water table and degree of water content in the subsurface.

3) **Core Drilling:**

- To obtain core of soil or rock samples in order to determine the properties, and analyze the conditions of substratum in terms of their suitability for housing development.
- To determine the Standard Penetration Test (SPT) N-values at various depth in the boreholes.

## 3. Scope of Services:

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**Identification and assessment of subsurface soil conditions, and potential geological and other hazards and impacts on environment:** This should be based on desk study, field explorations and laboratory tests in the identified area. The field investigations should be supplemented with various baseline data (maps, satellite imagery, scientific literature etc.).

The scope of work for the entire study area to be investigated includes, but not limited to the following:

- a) Undertake field trips to the identified area and carry out detailed field explorations as described in the following **subsection 3.1** to confirm the earlier geotechnical findings.
- b) Assess and validate the earlier geotechnical and hazard maps on the ground.
- c) Identify and assess any changes in topography and geomorphologic features after the completion of earlier geotechnical investigation.
- d) Identify and assess marshy areas, ground instabilities, water bodies (springs, seepages etc.) that are recently developed and have significant impacts on the study area.
- e) The results of subsurface explorations shall be fully discussed in the report including recommendations and potential engineering solutions.
- f) Based on the findings, all the engineering specifications covering foundation design, depth, excavations and mitigation details must be included in the report, which shall be used later during the site execution.
- g) Conduct laboratory tests and analysis for the samples collected from the sites to determine the geotechnical properties. The lab tests shall include all the details as prescribed in the **subsection- 3.2** below.



**The field and laboratory tests procedures shall be carried out in accordance with the specified international standard (e.g., ASTM Standard, British Standard and International Society of Rock Mechanics (ISRM) and the Indian Standards:**

- IS: 2131 – 1981 Method for Standard Penetration Test for soils (First Revision)
- IS: 15736: 2007 Geological exploration by geophysical method (electrical resistivity) – Code of practice.
- IS 15681:2006 Geological exploration by geophysical method (Seismic Refraction) – Code of practice.
- IS 2720(part 17): 1986 Indian Standard Methods of test for soils: Laboratory, Determination of Permeability (First revision)
- IS 5529(part 1): 2013 IS In-situ Permeability tests

### **3.1: Field Investigations:**

Geotechnical investigations shall be performed to obtain data on physical characteristics of soil/rock of the identified project site. The investigations shall cover the following:

- a) Geophysical Survey- Seismic Refraction Test (SRT).
- b) Geophysical Survey- Electrical Resistivity Test / Tomography (ERT).
- c) Core Drilling.
- d) Standard Penetration Test (in the boreholes).
- e) Permeability Test (in the boreholes).

**The test locations shall be identified and determined in close collaboration with the client engineers, and approved by the NHDCL management.**

Skilled Drilling Crew-Technicians or Foreman shall be deployed, and all the field tests shall be directed, supervised and monitored by the Geotechnical Expert(s)-Team Leader.

All the boreholes shall be sealed after completion by backfilling and proper compaction.

All the test locations shall be recorded using high-end GPS coordinates (Easting, Northing and Elevation with test descriptions). All investigation logs, field findings and GPS records shall be in GIS database (ESRI geodatabase formats) for future use.

The consultancy firm shall perform all field work in accordance with its Site-Specific Health and Safety Plan. The firm is responsible for ensuring safety of an environment and its personnel. The procuring agency is not liable in case of any injury/accident occurred during the fieldwork.

All the exploratory tests shall conform to the requirements as described below.

#### **3.1(a): Geophysical Survey- Seismic Refraction Test (SRT):**

The main purpose of this test is to determine the potential weak zone of the slope in the study area. It shall be carried out to identify the instability, obtain subsurface profile and location of weak zone such as fractures, fault and information of all overlying layers including soil thickness, bedrock profile, rock quality & depth, topography of ground water / water table. This survey shall be performed to furnish insight in to the slope stratigraphy, as well as the dimensions of sliding area, depths of slope failure surfaces and the lateral extent of landslides. It also includes identifying sliding surface geometry, water effect on

slope, landslide material physical properties and mass movement. **Intercept-Time, General Reciprocal Method (GRM)** and **Refraction Tomography** methods shall be used to interpret seismic refraction data. Refraction data shall be analyzed using recognized software package to obtain seismic velocity profile distribution. Field observations and drill-hole data shall be used to verify the accuracy of seismic refraction data. The seismic refraction data shall be used to produce two-dimensional (2D) images of subsurface of all potential weak areas. The results of seismic investigation shall be integrated with other subsurface data for slope stability analysis.

SRT Requirements	
Number of Tests	Details
<ul style="list-style-type: none"> <li>❖ <b>5 Profile Lines.</b></li> <li>❖ Each Profile Length = <b>115 m.</b></li> </ul>	<ul style="list-style-type: none"> <li>• The test shall be performed using Seismograph of signal enhancement type fully digital, 24 channels along with all other accessories- High frequency Geophones, Spread cable (water proof joints) with 24 take-outs, 8-10 kg Sledgehammer, Striker Plate, Controller (Laptop), and appropriate data processing software, preferably a product from Geometrics Inc.</li> <li>• Prior to collecting seismic data, field reconnaissance shall be carried out to determine most suitable locations of seismic lines.</li> <li>• The procedure for carrying out the test, recording and analysis of results and their presentation shall conform to International Standard.</li> <li>• A high-resolution seismic refraction method shall be used in all targeted areas to collect refraction data within a minimum accuracy of 5% of actual depths.</li> <li>• Shot points (signal generation locations) shall be conducted along the lines at the ends, midpoint, and intermediate points between the ends and the midpoint.</li> <li>• Both General Reciprocal Method (GRM) &amp; Refraction Tomography methods shall be used to interpret seismic refraction data.</li> <li>• Use of <b>explosives</b> is not permitted.</li> <li>• All these tests shall be undertaken by a suitably qualified and experienced geotechnical expert(s) <b>or</b> trained skilled geotech technician(s) under the guidance of geotechnical expert(s) / Team Leader. Copies of CV should be included in the proposal responding to TOR, if the firm is outsourcing to any subcontract of specialist nature.</li> <li>• Proper care during testing shall be taken to</li> </ul>

	<p>avoid disturbance caused due to the movement of vehicle or other working operations around the test location.</p> <ul style="list-style-type: none"> <li>• Shall maintain record of Location Name, GPS Coordinates and Date of tests carried out.</li> </ul>
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**3.1(b): Geophysical Survey- Electrical Resistivity Test / Tomography (ERT):**

The ERT method shall be used to map geologic variations including- soil lithology, presence of ground water, fracture zones, variations in soil saturation and to map subsurface karst (sinkholes, fissures, underground streams etc.)

The field data obtained from this test shall be correctly processed to generate 2D resistivity profile using RES2DINV software or any other **internationally recognized industrial software conforming to international standard.**

ERT Requirements	
Number of Tests	Details
<ul style="list-style-type: none"> <li>❖ <b>5 Profile Lines.</b></li> <li>❖ Each Profile Length: (60-1) electrodes x 5m = <b>295m.</b></li> </ul>	<ul style="list-style-type: none"> <li>• The test shall be performed using Electrical Resistivity Tomography 2D Resistivity Imaging, 60 channels (i.e., 60 electrodes) along with all other accessories</li> <li>• Prior to collecting ERT data, field reconnaissance shall be carried out to determine most suitable locations of electric profile lines.</li> <li>• The procedure for carrying out the test, recording and analysis of results and their presentation shall conform to International Standard.</li> <li>• Electrode spacing shall be 5m.</li> <li>• All these tests shall be undertaken by a suitably qualified and experienced geotechnical expert(s) <b>or</b> trained skilled geotech technician(s) under the guidance of geotechnical expert(s) / Team Leader. Copies of CV should be included in the proposal responding to TOR, if the firm is outsourcing to any subcontract of specialist nature.</li> <li>• Shall maintain record of Location Name, GPS Coordinates and Date of tests carried out.</li> </ul>

**3.1(c): Core Drilling:**

The intention of this test is to determine the ground (soil and rock) properties and characteristics to confirm and substantiate the results of geophysical surveys in the proposed housing site. Exploratory drilling provides visual insight of geological and geotechnical profile of the explored site. Boreholes shall be used for sampling materials from greater depths which is not possible with trial pits and other methods. The Standard Penetration Test for soil and Rock Quality Designation (RQD) for rock types shall be included in this borehole test. Disturbed samples shall be collected for soil type verification and retained in suitable wooden boxes following the investigation for a period of one year and must be handed over to NHDCL

for future records. Undisturbed sample shall be tested for moisture content, bulk density and unconsolidated undrained triaxial compression strength test and mechanical analysis for all the boreholes. For the rock, the consultant shall determine the depth of disintegration zone (RDZ) for each boring, and also determined the percent recovery and rock quality designation (RQD) for each core run.

After core extraction from the exploration borehole, the firm shall examine and describe the **borehole profile**. The borehole profile includes depth tags, ground types, layer changes, extensive description of the types and characteristics of individual layers and standard markings. In addition, the data on drilling tests and lab tests shall be included in the profile. Such results will provide accurate insight into the sequence and properties of layers at different ground depths.

Core Drilling Requirements	
Number of Boreholes	Details
<p><b>Total = 4- Boreholes</b>  <b>(1 No= 50 m length,</b>  <b>3 Nos= 15, 20 and 30 m)</b></p> <p>(Notes: Length of boreholes shall be determined by the results of SRT/ERT tests where by presence of bedrocks would be the ultimate end of boring)</p>	<ul style="list-style-type: none"> <li>• <b>Depth</b> of Borehole shall be <b>15m to 50m</b> of varying depth from the natural ground level.</li> <li>• Appropriate <b>casing types</b> and <b>sizes</b> shall be used to obtain best core samples.</li> <li>• <b>SPT</b> shall be carried out in the boreholes at regular interval, and recover the samples for laboratory tests.</li> <li>• Collect undisturbed Soil Samples, if cohesive soil strata are met.</li> <li>• Shall collect at-least <b>3 to 4 samples</b> from each borehole for laboratory test, out of which samples shall be <b>rock core, 2 to 3</b> for <b>soil core</b> for laboratory testing.</li> <li>• Shall observe and maintain record of ground water table.</li> <li>• Shall carry out visual and tactile examination of each sample, describe material type (soil/rock) and maintain record of <b>Depth</b> from the surface, elevation details and photographic records of each sample shall also be maintained.</li> <li>• Borehole log shall be as per relevant IS Code.</li> <li>• Describe Borehole Test No. / Location ID, Name of Location, GPS Coordinates and Date of Borehole tests.</li> </ul>

**3.1(d): Standard Penetration Test (SPT) in the Boreholes:**

This test shall be conducted to determine the corrected SPT N-value against factors like water table, overburden pressure, etc., in all types of soil deposits met within the bore hole to find the variation in the soil stratification by correlating with the number of blows required for unit penetration of a standard penetrometer. This test shall be conducted at 2.50m intervals, at every change of strata, at depths wherever undisturbed soil samples cannot be collected and as per the directions of the client’s counterpart official(s). The starting depth of performing SPT shall be at 2.50m depth below ground level. The depth interval between the top level of standard penetration test and to that of (next) undisturbed sampling shall not be less than 1m. The specification for equipment and other accessories, procedure for conducting the test, presentation of test results and collection of disturbed soil samples etc shall conform to the relevant IS code.

SPT Requirements	
Number of Tests	Details
<p><b>3 to 4 Tests</b> in each <b>Borehole</b></p> <p><b>Total = 16 Tests (Approximate)</b></p> <p>(Notes: Nos of SPT shall be determined by SRT/ERT tests whereby the length of borehole will be determined and then no of SPTs will be determined)</p>	<ul style="list-style-type: none"> <li>• The starting SPT shall be in interval of <b>3.0 m</b> starting from <b>3.0 m to</b> below the natural ground level. However, number of tests shall be determined by the SRT/ERT tests.</li> <li>• The test shall be carried out by driving a standard split spoon sampler in the borehole.</li> <li>• The SPT shall be conducted at a regular interval in each borehole.</li> <li>• The test procedure shall be as per IS Code of Practice.</li> <li>• The SPT N-value and the depth from natural ground level shall be recorded including borehole ID and location name.</li> </ul>

**3.1(e): In-situ Permeability Test in the Boreholes:**

The field permeability test shall be carried out in the boreholes to determine permeability of subsurface soil/rock strata as well as to ascertain overall permeability of strata.

The permeability of rock is an important property that is used for the classification of rock and in the design of structures in, on, or with rock. Permeability property controls the movement of and storage of fluids in rocks and represents an important characteristic of materials. Based on known permeability, possible solutions of engineering constructions shall be recommended.

Permeability and porosity also have impact on rock weathering. When there is a certain degree of strong weathered and weak interlayer in the slope due to water softening effect of weak interlayer, the slopes are more prone to instability.

The borehole and permeability data shall be used for slope stability analysis.

Minimum Requirements	
Number of Permeability Test	Details
<p><b>Total Permeability Test:</b> = <b>15 tests</b> for <b>Soil Core</b>, = <b>10 tests</b> for <b>Rock Core</b>.</p>	<ul style="list-style-type: none"> <li>• These tests shall be performed to determine the permeability of soil and rock strata in the subsurface.</li> <li>• The <b>permeability tests</b> shall be conducted in the Boreholes.</li> <li>• <b>3 to 4 tests</b> for <b>Rock permeability</b> in each borehole, and</li> <li>• <b>2 to 3 tests</b> for <b>Soil permeability</b> in each borehole.</li> <li>• Permeability for Soil Core shall be tested by Constant Head method and Packer Test for Rock Core.</li> <li>• Ensure a proper record of rock properties such water tightness, fractures etc.</li> <li>• The results obtained shall be documented properly and interpolated along with the results of core drilling.</li> <li>• The observations shall be suitably recorded in appropriate format and analyzed.</li> <li>• Maintain Test No. / ID, Name of Location, GPS Coordinates and Date of test carried out.</li> </ul>

### 3.2: Laboratory Testing:

Tests for all the samples collected from field shall be carried out in a material testing laboratory in accordance with International Standards Codes **or** as per relevant Indian standard codes. The following types of tests shall be carried out for core samples.

Sl. No.	Descriptions	Remarks
1	Grain Size Analysis of Soil Samples	For Soil Core Samples
2	Specific Gravity	
3	Natural Moisture Content	
4	Density Test (Bulk & Dry Density)	
5	Atterberg Limits (Liquid Limit & Plastic Limit)	
6	Proctor Compaction Test	
7	Direct Shear Test	
8	Consolidation Test	
9	Unconfined Compression Tests (UCS)	For Rock Core Samples

### 3.3: Slope Stability Assessment:

Analysis of **slope stability** shall be carried out in the study area. The stability of these slopes should be assessed to determine the potential risk of failure. It shall include inspections / observations of the existing slope conditions, and to identify any potential areas of concern observed on the slope from a geotechnical perspective.

**Slope Stability Analysis:** The evaluation of slope stability and assessing failure shall be determined based on **slope stability analysis** under static and dynamic (earthquake) conditions. Its main objectives are to evaluate how safe a slope is, and to calculate the factor of safety for a slope before its failure; and to recommend/propose appropriate methods for enhancing stability of unstable slopes by possible remedial measures. The stability analysis should be carried out using **internationally recognized industrial software conforming to international standard**. The analysis results should be demonstrated in either 2D or 3D slope stability models.

Slope stability analysis of soil and rock slopes must include:

- Depth and configuration of the failures.
- Soil/rock classification, strength and density of soil/rock materials and the configuration of soil / rock strata, including basic geological indicators (strike/dip) and other features such as fissures, faults, discontinuities etc.).
- Groundwater table and surface/subsurface soil moisture conditions.
- Analyze the stability of rock / soil slopes and determine if the existing slopes faces are likely to fail (planar sliding along a discontinuity, wedge failure, or toppling failure).

The **material type** and **strength properties** shall be adopted for the stability analyses based on slope behaviour; ground conditions revealed from the borehole's investigations. The parameters shall embrace grain size, specific gravity, permeability, shear strength (cohesion, angle of internal friction and unit weight of soil), thickness of sliding mass, size of slide (length, depth and width) etc. Soil and rock parameters should be based on the results of subsurface explorations, which includes in-situ field-testing and / or a laboratory-testing program, used separately or in combination. While selecting parameters, the consulting firm should determine very appropriate and critical parameters which will give precise results or within an acceptable level of accuracy.

The analysis shall include the following data in the stability model.

Parameter	Input Data
Soil Profile	From detailed assessment of Soil Stratigraphy
Slope Geometry	Shall derive from Topo, Survey Data or DEM
Soil Shear Strength	From Laboratory and In-Situ/Field Tests

The geometries of the cross sections shall be considered as described below.

Location	Cross Section	Slope Height (m)	Overall Inclination from Horizontal (degrees)
	e.g, A-A		

#### Analysis Methods:

The consulting firm should choose the best method (s) suited for stability analyses such as Limit Equilibrium (LE), Finite Element Method (FEM), Numerical Method of Modeling (NMM) etc. depending on in-situ condition and slope properties. The analyses method(s) shall have capable of modeling all conditions including seepage, high water table, cracks, liquefaction potential, seismic forces etc.

The slope stability analysis shall include both **static** and **dynamic** loading (earthquake) conditions for deriving factor of safety of slopes.

For simple rock or rock sliding slopes, Empirical Methods, Kinematic Methods, Limit Equilibrium Techniques **or** combinations of these methods shall be applied. However, in case of complex rock slopes, hybrid numerical methods are recommended to better understand the behaviour of rock slope.

#### 4. Reporting and timing of the assignment:

The duration of this consultancy work is **Sixty (60) days**, and all the activities shall be completed within this timeframe. It includes **Thirty (30) days fieldwork** and **Thirty (30) days** to review the study as stipulated in the scope of work **or** as felt relevant by the consultant. The consulting firm shall work closely with NHDCL officials.

**(i) Inception Report:** The Inception Report (**2 color hard copies** and **1 softcopy**) should be submitted to NHDCL within **Seven (7) days** from the date of award of contract. The Inception Report shall fully describe the work plan, study methodologies, role and responsibility of key experts and other supporting staff who are engaged in this project, and their assigned tasks. It shall also include the current progress status and other pertinent information.

**(ii) Draft Report & Datasets:** **1 color hard copies** and **a softcopy report** and **datasets** should be submitted within **Fifty (50) days** from the date of award of contract.

The consultant shall conduct a daylong seminar/workshop/discussion to present the **findings** and **recommendations** to the NHDCL officials and other relevant stakeholders for comments. The comments shall be incorporated in the final report.

**(iii) Final Deliverables:** Final Report (**3 color hard copies** and **1 softcopy**) with all other deliverables shall be submitted within **Five (5) days** after the receipt of the final comments from Client and other stakeholders. The borehole log samples securely preserved/arranged in casing (steel or wooden) shall be submitted to the NHDCL.

## 5. Report Submittal Format:

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Detailed exploration report shall be submitted in both hard and soft copy. It shall include the executive summary, technical details and recommendations supplemented with relevant maps, mitigation drawings and diagrams, stability analysis and diagrams and other annexure / Appendices as described below. The softcopy maps shall be in the form of GIS formats (Shape / Geodatabase) with well-structured and defined datasets. The softcopy report, maps and datasets shall be submitted.

**Contents of the Report:** Shall include technical descriptions viz. subsurface exploratory methodology, findings, field records/log, relevant maps, models/profiles, slope stability results, conclusion and recommendations. All the test results and analysis (both field and laboratory samples), Field Logs, Maps, Stability Analysis Models, Mitigation Drawings and Diagrams shall be attached in the report as **appendices**.

## 6. Support services to be provided by the client:

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The following services and facilities will be provided by the Procuring Agency:

- 1) **The maps- topographic datasets** (digital copy) of the study area.
- 2) Assist the consultants to avail themselves the available resources from other organizations viz. geotechnical related studies, reports, data etc. upon a written request from the consultant.
- 3) Assist the consulting firm to process for work & special route permit for foreign nationals.
- 4) In order to conduct the study smoothly, the Procuring Agency will seek the concerned Thromde's support to avoid any obstruction that impedes the field works.
- 5) The counterpart staff of the Procuring Agency will monitor the quality and progress of work from time to time, verify the invoices, conducting meetings, discussions, arrangement of final presentation etc.
- 6) The Team Leader should fully engage with team throughout the field explorations.

The consultant shall work closely with NHDCL. The client may also, at its discretion, consider fielding of its representative to accompany the consultant's study team during fieldwork. However, the responsibility of completing the assignment successfully will lie solely with the consultant.

## 7. Breakdown of Activity by Quantity:

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The '**breakdown of activity by quantity**' is prepared to give clear idea to the bidders for pricing their consulting services. It is to be noted that, the payment **shall not** be made on itemized price under this Lump-sum contract. The purpose is to derive realistic cost while offering financial proposals covering all the following activities required for this geotechnical assignment.

The **breakdown of costs by activity** in the **financial proposal** must consist of **all the activities** as described below.

All the activities must be carried out as per the technical specifications specified in the scope of work. The identifications and finalization of all exploration sites shall be done in consultation with the Procuring Agency.



Sl. No.	Description of Activities	Unit	Qty	Remarks
<b>A</b>	<b>FIELD TESTS:</b>			
1	Geophysical Survey: <b>Seismic Refraction Test</b> (Each profile of 115m length).	mtr.	575	
2	Geophysical Survey: <b>Electrical Resistivity Test</b> (Each profile of 295m length).	mtr.	1475	
3	<b>Core Drilling</b> & Backfilling the hole with Grout /Concrete. 4-Boreholes of depth varying from 15m to 50m.	mtr.	115	
4	SPT in Boreholes. 4 SPTs in each borehole.	Nos	16	
5	Constant Head Test ( <b>CHT</b> ) in Boreholes for testing <b>Soil Permeability</b> .	Nos	15	
6	<b>Packer Test</b> in Boreholes for testing <b>Rock Permeability</b> .	Nos	10	
<b>B</b>	<b>LABORATORY TESTS:</b>			
7	Geotechnical Lab Test for <b>Soil Core Samples</b> (Sieve Analysis, Bulk Density, Dry Density, Specific Gravity, Plastic & Liquid Limit, Consolidation & Direct Shear, and Proctor Compaction Test).	Nos	16	<b>4 Samples from each Borehole</b>
8	Geotechnical Lab Test for <b>Rock Core Sample</b> - Unconfined Compression Tests (UCS)	Nos	10	<b>2 to 3 Samples from each Borehole</b>
<b>C</b>	<b>DESK WORK:</b>			
10	Preparation of <b>Report(s)</b> ; including data interpretation and analysis, data processing and mappings and model generation printing documents and submission etc. covering all others, to complete the required deliverables including presentation to the Client.  Study, analysis, calculation works & preparation of reports on Slope stability Analysis based on core drilling results.			

	<b>Experts' HOME OFFICE INPUT (in man-day) required for DESKWORK</b>			
a)	Team Leader:	day		
b)	Drilling Supervisor and Technicians	day		
c)	Geophysical Surveyors /Technicians	day		
d)	GIS Expert: (In case if the inputs of GIS Expert are required as per the proposal of the firm.)	day		
<b>D</b>	<b>OTHER COSTS INVOLVED IN THIS PROJECT:</b>			
a)	<b>Mobilization / Field Office Management:</b> This includes <b>all costs</b> associated with field transportations / hiring of vehicle(s) for field staff, hiring of field equipments, rental charges for apartment(s) in the field etc. required to carry-out field activities.	Lump-sum		
b)	<b>Home Office Management:</b> This includes <b>all costs</b> for the home office expenses, such as rentals, support staff, office manager, telephones, internet charges, local transportation etc. required to carry-out home office activities.	Lump-sum		

## 8. Conditions of Responsiveness:

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To be substantially responsive bid, the following conditions must be fulfilled.

1. The consultant must provide the evidence of at least two (2) similar works of same nature executed for the last 3 years in Bhutan.
2. The consultant shall furnish/submit letters from the organizations or clients to support the evidence of above Sl. No.1.
3. The consultant shall submit the evidence of availability of equipment owned/hired. if firms intend to hire from other organization / agency / business entity, a **hiring agreement** duly signed by both the parties shall be submitted.
4. The consultant shall submit the evidence of Team Leader with geotechnical back ground with minimum Bachelor / Masters in geotechnical or engineering geology with past experiences.
5. The commitment letter from Team Leader shall be submitted to engaged in the field during field explorations.
6. Preference shall be given to firms with local experts to conduct the study.

**ANNEXURE 1: SITE LOCATION MAP**

