# MR 262/2024

# CARRY OUT GEO-TECHNICAL INVESTIGATION FOR TAMAVUA-I-WAI & WAILEKUTU 33KV TRANSMISSION LINE CROSSING BRIDGE PROJECT FOR ENERGY FIJI LIMITED

## ENERGY FIJI LIMITED



## REVISION HISTORY & DOCUMENT CONTROL

| Rev No. | Notes | Prepared By | Reviewed & Approved By | Date of Issue |
|---|---|---|---|---|
| 1 | Issued for tender | Amitesh Arunesh Chand | Krishneel Prasad & Shavneel Deo | 16/08/2024 |
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# 1 BACKGROUND

Energy Fiji Limited ("EFL") is a limited liability company that was established under the Companies Act (2015), Laws of Fiji. It is supervised by a Board of Directors comprising representatives from its major shareholders.

The Executive Management team of EFL consists of the Chief Executive Officer, Deputy Chief Executive Officer, Chief Operating Officer, Chief Finance Officer, General Manager Human Resources, General Manager Generation, General Manager Network, General Manager Customer Services, General Manager System Planning and Control, General Manager Special Projects and Chief Information Officer.

EFL is primarily responsible for generation, transmission and distribution of electricity in Viti Levu, Vanua Levu, Ovalau and Tavueni in Fiji. It owns over twenty (20) power stations and twenty (20) substations and switching stations on the islands of Viti Levu, Vanua Levu, Taveuni and Ovalau. EFL owns, operates and maintains a network of 147km of 132kV transmission lines, 534.86km of 33kV lines and over 10,500km of 11kV and 415V distribution lines, as at 31st December 2022.

EFL is undertaking investments to develop the electricity generation, transmission and distribution networks to continue to meet power supply requirements for its customers. As part of this project, EFL seeks competitive tender bids from registered surveyors in Fiji to carry out survey of Tamavua-i-wai and Wailekutu site. The location of the site is as given in these specifications.

During evaluation of tender bids, EFL may invite a tenderer or tenderers for discussions, presentations and any necessary clarification before proceeding further.

The deadline to submit tender bids is **1600hrs on 4th September 2024**, Fiji Time.
Further information relating to this tender may be acquired from:

Jitendra Reddy
Manager Procurement, Inventory & Supply Chain
2 Marlow Street, Suva, FIJI.
Phone: 679 3224 320/9992400
Facsimile: 679 331 6773
Email: tenders@efl.com.fj

# 2 INSTRUCTIONS FOR TENDERERS

## 2.1 Eligible Tenderers

This invitation is open to Tenderers who have sound Financial Background, and have previous experience in carrying out such work.

Tenderers shall provide such evidence of their continued eligibility satisfactory to EFL as EFL shall reasonably request, using the forms provided in the Schedules.

Tenderers shall not be under a declaration of ineligibility for corrupt or fraudulent practice.

## 2.2 Eligible Materials, Equipment and Services

The materials, equipment, and services to be supplied under the Contract shall have their origin from reputable companies and countries and all expenditures made under the Contract will be limited to such materials, equipment, and services. Tenderers shall be required to provide evidence of the origin of materials, equipment, and services in their bids.

For purposes of this Contract, "services" means the works and all project-related services including design services.

For purposes of this Contract, “origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing or substantial or major assembling of components, a commercial recognized product results that is substantially different in basic characteristics or in purpose or utility from its components.

The services to be provided under the Contract shall not infringe or violate any industrial property or intellectual property rights or claim of any third party.

## 2.3 One Bid per Tenderer

Each Tenderer shall submit only one bid. A Tenderer who submits or participates in more than one bid will cause all those bids to be rejected.

## 2.4 Cost of Bidding

The Tenderer shall bear all costs associated with the preparation and submission of its bid and EFL will in no case be responsible or liable for those costs.

## 2.5 Site Visits

Wednesday **21st August, 2024 at 10.00am** at Tamavua-i-wai & Wailekutu Bridge site.

## 2.6 Contents of Bidding Documents

The Tenderer is expected to examine carefully the contents of this Bidding document. Failure to comply with the requirements of bid submission will be at the Tenderer's own risk. Bids which are not substantially responsive to the requirements of the bidding documents will be rejected.

## 2.7 Clarification of Bidding Documents

A prospective Tenderer requiring any clarification of the bidding documents may notify EFL in writing by email addressed to:

Jitendra Reddy
Manager Procurement, Inventory & Supply Chain
2 Marlow Street, Suva, FIJI.
Phone: 679 3224 320/9992400
Facsimile: 679 331 6773
Email: tenders@efl.com.fj

EFL will respond to any request for clarification which it receives earlier than **five (5)** days prior to the deadline for submission of bids.

## 2.8 Amendment of Bidding Document

At any time prior to the deadline for submission of bids, EFL may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Tenderer, modify the bidding documents by issuing addenda.

## 2.9 Language of Bid

The bid, and all correspondence and documents related to the bid, exchanged between the Tenderer and the EFL shall be written in the English language.

## 2.10 Bid Prices

Unless specified otherwise, Tenderers shall quote for the entire facilities on a “single responsibility" basis such that the total bid price covers all the Supplier’s obligations mentioned in or to be reasonably inferred from the bidding documents in respect of the design, manufacture, including procurement and subcontracting (if any), testing and delivery.

Tenderers shall give a breakdown of the prices in the manner and detail called for in the Schedules of this bidding document, or any issued addenda.

## 2.11 Bid Currencies

Prices shall be quoted in a single currency **FJD VIP** only and shall be inclusive of all applicable taxes.

## 2.12 Bid Validity

Bids shall remain valid for a period of **90 days** from the date of Deadline for Submission of Bids specified in Sub-Clause 2.15.

## 2.13 Format, Labelling and Signing of Bids

The Tenderer shall submit electronic copy of the Technical and Financial proposals on EFL's electronic tender hosting website, https://www.tenderlink.com/efl . **EFL will not accept any hardcopy submissions.**

The bid shall contain no alterations, omissions or additions, except those to comply with instructions issued by EFL, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person or persons signing the bid.

The bids shall:

a) be addressed to EFL as follows:

Jitendra Reddy
Manager Procurement, Inventory and Supply Chain
2 Marlow Street, Suva, FIJI.
Phone: 679 3224 320/9992400
Facsimile: 679 331 6773
Email: tenders@efl.com.fj

And

b) bear the following identification:

- Bid for: CARRY OUT GEO-TECHNICAL INVESTIGATION FOR Tamavua-i-wai & Wailekutu 33KV Transmission Line Crossing Bridge project for Energy Fiji Limited.
- Bid Tender Number: MR 262/2024
- DO NOT OPEN BEFORE: 1600hrs on 4th September 2024

## 2.14 Deadline for Submission of Bids

Bids must be received by EFL at the address specified above no later than 1600 hours (Fiji Time) 4th September 2024.

EFL may, at its discretion, extend the deadline for submission of bids by issuing an addendum, in which case all rights and obligations of EFL and the Tenderers previously subject to the original deadline will thereafter be subject to the deadlines extended.

## 2.15 Late Bids

Any bid received by EFL after the deadline for submission of bids prescribed above will be rejected and returned unopened to the Tenderer.

## 2.16 Modification and Withdrawal of Bids

The Tenderer may modify or withdraw its bid after bid submission, provided that written notice of the modification or withdrawal is received by EFL prior to the deadline for submission of bids. The modification or withdrawal of Bids notice shall also be lodged in the EFL electronic tender hosting website listed above.
No bid may be modified by the Tenderer after the deadline for submission of bids.

## 2.17 Rejection of One or All Bids

EFL reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the rejection.

## 2.18 Process to be Confidential

Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process.

Any effort by a Tenderer to influence EFL's processing of bids or award decisions may result in the rejection of the Tenderer's bid.

Lowest bid will not necessarily be accepted as successful bid.

## 2.19 Clarification of Bids

To assist in the examination, evaluation and comparison of bids, EFL may, at its discretion, ask any Tenderer for clarification of its bid. The request for clarification and the response shall be in writing or by fax, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by EFL in the evaluation of the bids.

## 2.20 Compliance with Specifications

The tender shall be based on the equipment and work specified and shall be in accordance with the Technical Specification. It should be noted that unless departures from specifications are detailed in Schedules of the Technical Specification, the tender would be taken as conforming to the Specification in its entirety. The Tenderer shall tender for the whole of the Works included in the Specification.

## 2.21 Signature of Tenderer

A tender submitted by a Partnership shall be signed by one of the members of the Partnership and shall be accompanied by a certified authorization of all the partners authorizing the individual partner to sign on behalf of the Partnership. A tender submitted by a Corporation to the Contract and shall be accompanied by a certified resolution of the Board of Directors authorizing the individual to sign on behalf of the Corporation.

## 2.22 Insurance

The Tenderer is to confirm that they have in effect the insurance policies below and provide copies of valid certificates with the bid:

1. Professional indemnity : $250,000.00
2. Public and Products Liability Insurance : $250,000.00

# 3 GENERAL CONDITIONS OF CONTRACT

The General Conditions of Contract shall be FIDIC Client/Consultant Model Services Agreement – Fifth Edition 2017 (White Book).

# 4 ADDITIONAL CLAUSES TO GENERAL CONDITIONS OF CONTRACT

EFL will provide during the contract stage.

# 5 SCOPE OF WORK

## 1. Introduction and Objectives

- **Project Overview**

  This project involves the construction of a new cable bridge across the River/Valley in Tamavua-i-wai and Wailekutu. The bridge will span approximately 90 meters and will support EFL 11kv & 33KV cable.

- **Objectives**

  The primary objective of this technical investigation is to assess the geotechnical and geological conditions at the bridge site to ensure the safe and stable design of the bridge foundations. This includes evaluating soil properties, groundwater conditions, and potential environmental impacts.

**2. Site Description**

- **Location**

  The site is located at Tamavua-i-wai (Lat:-18.114949; Lon: 178.431566) and Wailekutu (Lat:-18.102918; Lon: 178.388694). The area is located by Main Highway (king's road).

- **Existing Conditions**

  The site features consist of mangroves on both ends and settlement on one end. Also note the FRA old bridge is under demolishing stage.

**3. Scope of Investigation**

**Geotechnical Surveys**

**3.1 Site preparation**

Contractor shall prepare the site whatever is required for Geo-technical investigation, includes the access to site for drilling machine and backfill to prepare the proper foundation for the Geo-tech drilling machine. Clearing of site which consist of mangroves. EFL will provide the permit from ministry of environment.

**3.2 Borehole Drilling**

a. Drill 5 boreholes to a depth until reach hard strata at the site Tamavua-i-wai and Wailekutu site (location attached). Boreholes will be used to obtain soil samples and

assess subsurface conditions. Bore holes shall be taken at specified locations to obtain information about the sub-soil profile, its nature and strength and to collect soil samples for strata identification and conducting laboratory tests. The diameter of the borehole shall be such as to permit collection of undisturbed sample of 90 mm to 100 mm diameter. However, the diameter shall be 150mm as per relevant code. The minimum diameter of the bore shall be 150 mm and boring shall be carried out in accordance with the provisions of standards and as per this specification.

b. All bore holes shall be extend up to depths where hard rock or surface is reached. If the strata with Standard Penetration Test (SPT) N Value greater than 100 with characteristics of rock is met with, prior to the specified depth, the bore hole shall be advanced further by chiselling. Chiselling shall be continued for a maximum depth of 20 cms or up to 2 hours whichever is earlier. During chiselling rock fragments shall be collected. Identification of rock strata shall be on the basis of visual examination of SPT sample and rock fragments. After it is established that rock is met with, borehole shall be advanced further by drilling in rock as specified in tender clause and core shall be collected. When the bore hole is terminated in soil strata, an additional Standard Penetration Test shall be carried out at the termination depth.
c. Casing pipe shall be used in the bore hole to support its sides when a side fall is suspected to occur inside the bore hole. When casing pipe is used, it shall be ensured that its bottom end is at all times less than 15 cms above the bottom of the bore hole and not below the level at which the test has to be conducted or sampling has to be done. In case of cohesionless soils the advancement of the casing pipe shall be such that it does not disturb the soil to be tested or sampled. The casing shall be advanced by slowly turning the casing pipe and not by driving.
d. If any obstruction to normal boring is encountered in any borehole, this obstruction shall be overcome by drilling and/or by chiselling. Chiselling will normally be paid at the contract rate for boring in soil at appropriate depths, unless a separate rate has been provided for in the contract.
e. In-situ tests shall be conducted or undisturbed samples (UDS) shall be collected in the bore holes at regular intervals and at change of strata or as decided by the Engineer. Representative disturbed samples shall be preserved for conducting various identification tests in the laboratory. Water table in the bore hole shall be carefully recorded and reported. No water/drilling mud shall be added while boring above ground water table. For cohesionless soil below water table, the water level in the bore hole shall at all times be maintained slightly above the water table.
f. The bore hole shall be cleaned using suitable tools up to the depth of testing or sampling, ensuring that there is minimum disturbance of the soil at the bottom of the bore hole. The process of jetting through an open tube sampler shall not be permitted. In cohesive soils, the bore hole may be cleaned using a bailer with a flap valve. Gentle circulation of drilling fluid shall be done when rotary mud circulation boring is adopted.
g. On completion of the bore hole, including the borehole in which special tests are conducted, the Contractor shall backfill all the bore hole as directed by the EFL. Note: 4 Machine boreholes required on foreshore, 2 at each end (per site) and 1 Machine borehole required on offshore in middle of the river (per site).

**3.3 Auger Boring:**

Auger boring can be adopted in soft to stiff cohesive soils above water table. Augers shall be of helical or post hole type which may be manually or power operated. While boring, care shall be taken to minimize the disturbance to the deposits below the bottom of the bore hole. The cuttings brought up by the auger shall be carefully examined in the field and the description of all the strata shall be duly recorded. No water shall be introduced from the top while conducting Auger boring. Note 2 auger boring required on foreshore, 1 at each end (per site).

**3.4 Percussion boring (Chiselling):**

This method can be adopted in soil with gravel and boulders when the boring has to be done at a fast rate. This method consists of breaking of the strata by repeated blows from a chisel or drilling bit and bailing out the debris at intervals by adding water into the bore hole. This method is not permitted unless otherwise specified.

### 3.5 Standard Penetration Test (SPT):

This test shall be conducted in all types of soil deposits met within a bore hole, to find the variation in the soil stratification by correlating with the number of blows required for unit penetration of standard penetrometer. This test shall be conducted at intervals agreed by the EFL and CONTRACTOR and every change of strata to the satisfaction of the EFL. The starting depth of performing SPT shall be 0.5m depth below ground level. This depth shall be staggered in alternate boreholes. The depth interval between the top levels of Standard penetration test and next undisturbed sampling shall not be less than 1.0 m. The specifications for the equipment's and other accessories, procedure for conducting the test, presentation of test results and collection of the disturbed soil samples.

For conducting the test, the bottom of borehole shall be cleaned properly and the spoon shall be properly and centrally seated in position in the borehole. It is necessary to ensure that drive hammer is of specified weight and has a specified free fall. It shall be ensured that energy of the falling weight is not reduced by friction between the drive weight and guides or between rope and winch drum. Only BIS recommended standard connecting rods shall be used for the test.

This test shall be carried out by driving a standard split spoon sampler in the bore hole by means of a 650 N hammer having a free fall of 0.75 m. The sampler shall be driven using the hammer and for 450 mm. While driving the number of blows for every 150 mm penetration and the penetration for every 50 blows shall be recorded. The number of blows for the last 300 mm drive shall be reported as N value. This test shall be discontinued when the blow count is equal to 100 and the penetration shall be recorded. Refusal shall be considered to be met with when the blow count is equal to or greater than 100. At the location where the test is discontinued the penetration and the number of blows shall also be reported. Sufficient quantity of disturbed soil samples shall be collected from the split spoon sampler for identification and laboratory testing. The sample shall be visually classified and recorded at the site and shall be properly preserved and labeled for future identification.

Note: 4 Machine boreholes required on foreshore, 2 at each end (per site) and 1 Machine borehole required on offshore in middle of the river (per site).

### 3.6 Soil Sampling

Collect soil samples at various depths for laboratory analysis. Include both disturbed and undisturbed samples.

General Requirement:

a. Sufficient number of soil samples shall be collected for reliable estimation of soil properties. The samples collected shall be either disturbed or undisturbed. Disturbed soil samples shall be collected for field identification and conducting tests such as sieve analysis, index properties, specific gravity, chemical analysis, etc. Undisturbed samples shall be collected to estimate the strength and settlement properties of the soil.
b. All the accessories required for sampling and the method of sampling shall conform to AS/NZS. All the disturbed and undisturbed samples collected in the field shall be classified at the site as per AS/NZS.
c. All the samples shall be identified with date, bore hole or trial pit number, depth of sampling, etc. It is also essential to mark an arrow pointing towards the top surface of the sample. Care shall be taken to keep the undisturbed soil samples and box samples vertically with the arrow directing upwards. The tube samples shall be properly trimmed at both ends and sealed with molten paraffin wax at both ends immediately after extracting the samples from the bore hole and suitably capped on both sides.

d. When the Contractor fails to collect the undisturbed soil sample at a specified depth the reason for the same shall be indicated in the borelog and the bore hole shall be advanced by 0.5 M. Subsequently, for cohesionless soil Standard Penetration Test shall be performed and for very soft cohesive soil field vane shear test shall be performed.
e. Precaution shall be taken to ensure that there shall not be any change in moisture content and disturbance of the soil samples and they shall be placed in a temporary store at the end of the day‘s work. All the samples shall be kept over a bed of sand, jute bags, saw dust, etc. and covered over on top with similar material. The bed and top cover shall be kept moist till they are properly packed in boxes. The Contractor shall be responsible for packing and transporting of all the samples from site to the laboratory within seven days after sampling with proper protection against loss and damage.
f. The CONTRACTOR shall properly store all the samples at site till they are transported to his laboratory for testing. Sampling tubes containing undisturbed soil samples shall not be exposed to direct sun and shall be kept in a shade covered with wet gunny bags All the samples shall be packed in wooden boxes using sand, saw dust etc. all around the samples before transportation to laboratory for testing.
g. The rock cores obtained by drilling shall be carefully removed from the core barrel and placed in a properly constructed wooden core boxes with hinged wooden covers as specified above. The cores shall be placed in the boxes in the correct sequence and with each run segregated accurately by labelled wooden blocks 25 mm thick. No box shall contain more than 6m of core. Depths of all runs shall be marked on the portions with paint.
h. The CONTRACTOR shall transport all samples to his testing laboratory as quickly as possible and test the samples.

### 3.6.1 Disturbed sample:

a. Disturbed soil samples shall be collected in bore holes at regular intervals to provide complete description of soil profile and its variation. Jar samples weighing approximately 10 N shall be collected in bore holes at 0.5 m intervals starting from a depth of 0.5 m below ground level and at every identifiable change of strata to supplement the boring records. Samples shall be immediately stored in air tight jars or polythene bags and labelled with bore hole number and depth.
b. In elevated areas, if superficial material is available in plenty, then bulk samples from a depth of about 0.5 m below ground level shall be collected to establish all the required properties to use it as a fill material. Disturbed samples weighing about 250 N shall be collected at shallow depths and immediately stored in polythene bags. The bags shall be sealed properly and they shall be kept in boxes.

### 3.6.2 Undisturbed Samples:

In each bore hole undisturbed sample shall be collected at every change of strata and at regular intervals of 3.0 m and as directed by the Owner. The starting depth of collection of UDS shall be between ground level and 1.0 m below ground level and as decided by the Owner. The starting depth shall be staggered in alternate boreholes. In cohesive soils collection of UDS shall be preferred in place of SPT. The depth interval between the top level of undisturbed sampling and standard penetration test shall be at least 0.5m. Undisturbed samples shall be 100 mm dia and 450 mm length. Samples shall be collected in such a manner that the structure of the soil and its moisture content do not get altered. The specifications for the accessories required for sampling and the sampling. Thin walled sampler shall be used to collect undisturbed samples by pushing the tube into the soil. The sampling tube shall have a smooth finish on both surfaces and minimum effective length of 450 mm. The area ratio of sampling tubes shall be less than 12.5%. However, in case of very stiff soils, area ratio upto 20% shall be permitted.

## 3.7 In-Situ Testing

### 3.7.1 Ground Water:

One of the following methods shall be adopted for determining the ground water table in bore holes as per relevant prevailing AS/NZS standards and as per the instructions of the EFL.

a. In permeable soils, the water level in the bore hole shall be allowed to stabilize after lowering it adequately by bailing. When the water level inside the bore hole is found to be stable, the depth of water level below ground level shall be measured. Stability of sides and bottom of the bore hole shall be ensured at all times.
b. For both permeable and impermeable soils, the following method shall be suitable. The bore hole shall be filled with water and then bailed out to various depths. Observations on the rise or fall of water level shall be made at each depth. The level at which neither a fall nor a rise is observed shall be considered as the water table elevation. This shall be established by three successive readings of water level taken at an interval of two hours.
c. In case any variation in the ground water level is observed in any specific boreholes, then the water level in these bore holes shall be recorded daily during the course of the field investigation. Levels in nearby wells, streams, etc. if any, shall be noted whenever these readings are taken.
d. If so called for, observation wells shall be drilled for the purpose of long term studies of the fluctuation in ground water levels and pressure. Either a Stand pipe or Piezometer shall be installed in selected previously drilled or specially drilled bore holes covering the complete site area. These shall be at specified depths as per the specifications and instructions of the Engineer. Daily water level readings shall be recorded immediately following the installation up to the time of leaving the site. At the end of field work, these installations shall be handed over in satisfactory working condition to the Engineer without disturbing their position so that the owner can continue further observations. It is important to install some Stand pipes and Piezometers prior to the coming monsoon, in order to record the local effects and variations in the ground water level during the period.

### 3.7.2 Static Cone Penetration Test:

Static cone penetration test shall be conducted to know the soil stratification and to estimate the various physical and engineering soil properties. The cone penetrometer shall be advanced by pushing and the static force required for unit penetration shall be determined. The test shall be conducted using a 200 KN capacity mechanically operated equipment up to the specified depth or refusal whichever is earlier. For this test refusal ‘means meeting a very hard strata which cannot be penetrated at the rate of at least 0.3cm/sec even when the equipment is loaded to its full capacity. At the ground level, pre boring up to 0.5m depth shall be permitted if the overlying strata is hard. No extra payment shall be made for boring. Continuous record of the penetration resistance shall be maintained. On completion of the test, the results shall be reported in an approved proforma.

### 3.7.3 Dynamic Cone Penetration Test:

Dynamic cone penetration test shall be conducted using bentonite slurry by driving a standard size cone attached to the bottom of a string of drill rods. The test shall be conducted upto the specified depth or refusal whichever is earlier. Refusal shall be considered when the blow count exceeds 150 for 300 mm penetration. The specification for the equipment and accessories required for performing this test, procedure, field observations and reporting of results shall conform to Relevant AS/NZS standards.

The driving system shall comprise of a 650 N weight having a free fall of 0.75 m. The cone shall be 65 mm diameter provided with vents for continuous flow of bentonite slurry through the cone and rods in order to avoid friction between the rods and soil. On completion of the test, the results shall be presented as a continuous record of the number of blows required for every 300 mm penetration of the cone into the soil in a suitable chart supplemented by a graphical plot of blow count for 300 mm penetration vs depth.

- **3.7.4 Vane Shear Test:**

  Field vane shear test shall be performed inside the bore hole to determine the shear strength of cohesive soils, especially of soft and sensitive clays, which are highly susceptible to sampling disturbance. This test shall be conducted by advancing a four winged vane of suitable size (75 mm or 100 mm diameter as per the soil condition) into the soil up to the desired depth and measuring the torque required to rotate the vane.

  Test may also be conducted by direct penetration from ground surface. If the cuttings at the test depth in the bore hole show any presence of gravel, sand, shells, decomposed wood, etc., which are likely to influence the test results substantially, the test at that particular depth may be omitted with the permission of the Engineer. However, the test shall be conducted at a depth where these obstructions cease to occur. On completion of the test the results shall be reported in an approved proforma as specified.

**3.7.5 Field California Bearing Ratio Test:**

This test shall be carried out to obtain the properties of soil required for the construction. The equipment's and accessories required for carrying out the test procedure, recording of observations and presentation of results shall conform to relevant prevailing standards. The test locations and depth shall be as agreed on by EFL and CONTRACTOR at site to meet the requirements of the Project.

**3.7.6 Seismic Refraction Test:**

a. This test shall be carried out to establish the rock and soil profiles of varying density. The dynamic shear modulus of the soils shall also be obtained from the results of this test. The specification for the equipment's and other accessories, procedure for carrying out the test, recording and analysis of results.
b. This test shall be carried out by inducing shock waves into the soil, at ground level or at a certain depth below by striking a plate, placed on the ground surface with a hammer or by exploding small charges in the soil. The shock waves shall be picked up through geophones placed on the ground surface at regular intervals in line with the plate along a straight line. The time elapsed before the waves reach the geophones shall be recorded to an accuracy of one milli second or better.
c. The distance between the shock point and the geo-phones shall be increased to cover a wider area. Alternatively, multiple geo-phones shall be used simultaneously using multiple channel seismograph to record the arrival time and intensity of the waves reaching the geophones. The spacing of the geo-phones shall be 5 m. As the distance between the geophones and the shocks producing point are increased, the time lapse for the waves passing through different underlying strata and reaching the geophone shall be recorded. The wave forms shall be recorded for each test using multi-channel seismograph.
d. The test shall be conducted along traverses in two orthogonal directions as per the drawing or the instructions of the Engineer. During testing, proper care shall be taken to avoid disturbance caused due to the movement of vehicles or other working operations around the test location. The type of wave (compression or shear) shall be analyzed properly using the data recorded during the test.

**3.7.7 Laboratory Testing**

a. All laboratory tests shall be conducted in an approved laboratory using approved apparatus complying with the requirements and specification of Indian Standards or other approved standards for this class of work. It shall be checked that the apparatus are in good working condition before starting the laboratory tests. Calibration of all the instruments and their accessories shall be done carefully and precisely.
b. Depending on the type of sub strata encountered, appropriate laboratory tests shall be conducted on soil and rock samples collected in the field. Laboratory tests shall be scheduled and performed by qualified and experienced personnel who are thoroughly conversant with the work. Tests indicated in the schedule of items shall be performed on soil, water and rock samples as per relevant AS/NZS Codes indicated in

specification. One copy of all the laboratory test data records shall be submitted to the EFL progressively every week. Laboratory tests shall be carried out concurrently with field investigation since initial laboratory test results could be useful in planning the later part of field work. A schedule of laboratory tests shall be established by the Contractor and the same shall be submitted and got approved by the Engineer before starting of laboratory tests.

c. All samples, whether undisturbed or disturbed, shall be extracted, prepared and examined by competent personnel, properly trained and experienced in soil sampling, examination, testing and in using the apparatus as per the specified standards.
d. Undisturbed soil samples retained in liners or seamless tube samplers shall be taken out without causing any disturbance to the samples using suitably designed extruder just prior to actual testing. If the extruder is horizontal, proper support shall be provided to prevent the sample from breaking. For screw type extrudes, the pushing head shall be free from the screw shaft so that no torque is applied to the soil sample in contact with the pushing head. For soft clay samples, the sample from tube shall be cut by means of a high speed hacksaw to specified test length and placed over the mould before pushing the sample into it with a suitable piston.
e. While extracting a sample from a liner or tube, care shall be taken to see that its direction of movement is the same as that during sampling to avoid stress reversal.
f. On all undisturbed soil samples tested for bulk density, water content, grain size distribution, liquid limit and plastic limit tests shall also be performed.
g. On all rock samples tested for unconfined compression test, bulk density, water absorption, point load index tests shall also be performed.

### 3.7.8 Required Tests on Samples:

The CONTRACTOR is required to carry out the following tests and submit detailed reports with recommendations:

a. **Tests on Undisturbed and Disturbed Samples**
    1. Visual and Engineering Classification
    2. Sieve Analysis and Hydrometer Analysis
    3. Liquid, Plastic, and Shrinkage limits
    4. Specific Gravity
    5. Chemical Analysis
    6. Swell pressure and Free Swell index determination
    7. Proctor Compaction test
    8. California Bearing Ratio

**b. Tests on Undisturbed Samples**
    1. Bulk Density and Moisture Content
    2. Relative Density (for sand)
    3. Unconfined Compression Test
    4. Box Shear Test (in case of cohesionless and c- soil)
    5. Triaxle Shear Tests: (depending on the type of soil and field conditions on undisturbed or remoulded samples)
    6. Unconsolidated undrained.
    7. Consolidated Undrained Test with the Measurement of Pore Water Pressure.
    8. Consolidated Drained.
    9. Consolidation test.
    10. Laboratory Permeability Test

*“Note: Variation- No Variation will be allowed unless changes in scope or design by EFL.”*

### 3.7.9 Stockpiles and Disposal Areas

All excavated waste material shall be removed from the work site and legally disposed of on the day of excavation. Stockpiling or dumping of excavated material within the road reserve is not acceptable without prior approval of the Engineer.

Stockpile locations for pavement aggregate within road reserves shall be approved with the Engineer prior to use.

### 3.7.10 Land Entry Agreement

The Contractor, under the supervision of the Engineer shall be responsible for arranging land entry agreements to fulfill the Contractual requirements and must comply with all the conditions of access on to the land.

### 3.7.11 Publicity and Public Relations

Best possible public relations are to be maintained at work sites where the general public or any individuals are affected prior to, during, and after works are completed. The Contractor's staff shall be courteous to the public at all times, and shall not offer an opinion to any member of the public on work being carried out.

No public communication or announcement at any time to any third party, including any section of the media, about the Contract or the project shall be made by the Contractor without gaining written approval from the Employer beforehand.

All reasonable steps shall be taken to ensure that all affected property owners and occupiers, public transport operators, and any other identifiable groups or individuals are notified to the effect that the Works will have on them, the proposal timeframe and the contact person and day and night telephone number(s), should they have any problems. This notification shall be carried out a minimum of two days prior to the relevant work commencing.

The Contractor is to supply a draft letter to the Engineer for approval.

The letter must include;

- Explanation of work
- Date of disruption
- Contract number
- Contractor's name
- Information pertaining to site specific controls
- Access restrictions

### 3.7.12 Environmental Management

The Contractor shall comply with the Environmental Management Laws of Fiji. Prior to the commencement of works an Environmental Management and Monitoring Plan (EMMP) shall be prepared and submitted to the Engineer for review. The plan shall be finalized to incorporate any changes required by the Engineer and complied with for the duration of the Contract.

All works are to be programmed, constructed and maintained so as to minimize the impacts on the surrounding environment.

The EMMP shall as a minimum address:

- Stockpiles and disposal
- Dust Control
- Drainage and water crossing
- Sediment and storm water control
- Spill response and contamination

Before beginning works on any site, the Contractor shall ensure that the environmental safety measures are constructed and operational. Further, the Contractor shall have in place all contingency plans and emergency plans and procedures before starting work.

All incidents with possible significant environmental affects or outcomes shall be reported immediately to the Engineer.

The Following Conditions should be strictly followed by the Contractor.

- Earth works and construction works must cease during periods of heavy rain and adverse weather conditions.
- Works hours must be confine to daylight hours only from 7am-6pm. Works is prohibited at night. (unless written approval from Engineer)

- Refueling of vehicles and machineries must be undertaken 100m away from any waterways, in a bunded area to contain potential spills. Proper spill kits and spill procedures must be in place for any fuel or chemical spill.
- Contractor is strictly prohibited from washing his vehicles and machines in the water ways. If machinery is working adjacent or in the water, the machinery to be free from oil and fuel leaks.

## 4. Methodology

### 4.1 Fieldwork Procedures

Conduct field investigations following specific standards/procedures. Use appropriate drilling and sampling equipment.

#### 4.1.1 Codes and Standards:

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.

In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail.

All work shall be carried out as per the following AS/NZS Standards and Codes:

| Standards & Codes | Description |
|---|---|
| AS 1289.5.3.1—2004 | Methods of testing soils for engineering purposes |
| NZS 1170.5:2004 | Structural design actions - Part 5: Earthquake actions |
| AS 2159—2009 | Piling—Design and installation |
| AS/NZS 2312.1:2014 | Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings |
| NZS 4407:2015 | Methods of sampling and testing road aggregates |
| NZS 4402.2.8.1:1986 | Methods of testing soils for civil engineering purposes - Soil classification tests |
| NZS 4402.2.8.1 | Particle Size Distribution Coarse and Fine (Wet and Dry) |
| NZS 4402.2.8.4 | Particle Size Distribution (Hydrometer) |
| NZS 4402.2.7.1,2.7.2 | Particle density/ Soil density |
| NZS 4402.2.1/NZS 4407 | Moisture Content |
| NZS 4402.2,2.3,2.4,2.5 | Plasticity Index (liquid and plastic limits) |
| NZS 4402.6.1.1 | California Bearing Ratio |
| ASTM C1245-06 | Point Load |
| NZS 4407.3.15 | California Bearing Ration |

Note: The above Standards shall not be limited to, the contractor to advice and carry out the works as per the best industry practice and Standards.

4.1.2 **Data Collection and Management**

Record data using data collection methods, ensuring accurate and reliable documentation. Manage data in software/system for analysis.

4.1.3 **Data Analysis**

Analyze collected data using software/manual methods. Interpret results in relation to bridge foundation requirements.

4.1.4 **Reporting**

Prepare a comprehensive report including site investigation results, data analysis, and recommendations. The report will include maps, diagrams, and appendices with raw data.

**The site location is as shown in the map below.**


*Figure 1: The area hatched on the Locality Map is area subjected to Topography Survey for Tamavua-i-wai.*


*Figure 2: The area hatched on the Locality Map is area subjected to Topography Survey for Wailekutu.*

## 5. Timeline and Deliverables

### 5.1 Schedule

The anticipated program for the work is shown below.

| Milestone | Target Deadline |
|---|---|
| Close of Tender | 4/09/2024 |
| Award of Tender | 20/09/2024 |
| Issue of Purchase Order | 27/09/2024 |
| Site Mobilization | 2 Weeks after of issue of purchase order |
| Designing, drawing | 3 weeks |
| Submit to EFL for review | 2 Days |
| Acceptance by EFL | 1 Day |

5.2 Deliverables

Upon completion of the Geo-technical investigation, the following deliverables shall be provided to EFL:

a. Digital Geo-technical data in industry-standard formats suitable for use in engineering design applications.
b. Provide all necessary data that will help engineer to design the EFL cable crossing bridge and it foundation.
c. Geo-technical reports documenting the methods, procedures, and findings of the Geo-technical drilling.
d. Any additional documentation or supplementary materials requested by the client or project stakeholders.
e. Submit EFL with full set of hardcopies of A3 & A2 size.
f. Submit to EFL all the soft copes of Geo-technical report in PDF format.

**6.** Quality Assurance:

The Geo-technical investigation shall be conducted in accordance with industry best practices and standards for soil investigation. Quality control measures shall be implemented throughout the investigation process to ensure the accuracy and reliability of the collected data.

8. Project Team:

The Geo-technical investigation shall be carried out by a team of experienced engineers and technicians with expertise in Geo-technical investigation. The team shall be led by a licensed professional Engineer who will oversee all aspects of the Geo-technical investigation work.

9. Health, Safety, and Environmental Considerations:

The Geo-drilling team will adhere to all relevant health, safety, and environmental regulations and guidelines during field operations. Measures shall be taken to minimize any potential impacts on the environment and ensure the safety of personnel working in the field.

10. Stakeholder Coordination:

The Geo-drilling team shall coordinate closely with the client, project stakeholders, and regulatory agencies to address any concerns or requirements related to the topographical survey. Open communication channels shall be maintained throughout the survey process to ensure that project objectives are met effectively.

11. Budget and Cost Estimates:

A detailed budget and cost estimate for the topographical survey for both site shall be provided separately to the client prior to the commencement of fieldwork. Any additional expenses or unforeseen costs shall be communicated promptly and managed transparently throughout the project duration.

12. Supervision and Reporting

The EFL Project Manager for this work package will be General Manager Special Projects. The project will fall under Special Projects SBA. The Project Manager will appoint an EFL supervisor for liaison.

The successful tenderer will be required to provide fortnightly updates on the progress of work in an agreed format of reporting.

13. Schedule

The following is required:

- Detailed Company Profile
- FNPF & FRCS compliance certificate
- FNU compliance.
- Company Registration Certificate.
- Tin letter
- Company bank details
- Postal Address
- Accounts Contact person
- Company telephone contact

14. Payment Schedules and Terms

The payment will be based on **LUM-SUM** basis. EFL will not be making any advance payment for this work. **The prices quoted shall be inclusive of provisional tax for local service providers.**

Refer to the table below for Mode of Payments for Each Milestone.

| item | Description | Amount |
|---|---|---|
| 1.0 | Mobilization of necessary boring equipment's, other in situ test equipment's, men and materials to the project site for carrying out the geotechnical investigation and demobilization of the same after completion of all the field works etc all complete as per specification, drawing and as directed in scope. | |
| | Setting up boring rig at each bore hole location as directed in scope including Shifting of rig from one | |

| | | |
|---|---|---|
| 1.1 | borehole to other excluding first borehole on LAND. First setting of each rig deployed will not be paid as it is a paid under item 1.0<br><br>Note: Setting up boring rig at each borehole Location as per scope. (Any crisscross or back and forth movement of boring rig can take place. No additional compensation will be payable by the EFL for such movements). (The arrangement shall include formation of local mound for creation of platform for borehole drilling in the event of any inundation in the area). | |
| 1.2 | Making 150 mm nominal diameter boreholes at required locations in all types of soil/sand/ash including hardened laterite, weathered rock and soft rock (RQD<25%) using suitable approved method of boring including chiselling, cleaning, providing casing pipe as required or as directed; The starting depth of performing SPT shall be 0.5m below ground level. Collection of water samples and disturbed samples, observation such as ground water, etc., collection of undisturbed soil/ash samples at every 1.5 m interval and at change of strata and sealing the container; transportation of all the collected samples to the laboratory and back filling of boreholes with bentonite-cement grout on completion of the same, complete as per specification and instructions of the Engineer, for depths below natural ground level as given below:<br><br>a) From natural ground level until hard rock level is reach or<br><br>b) Until the Hard ground surface is reach which will be suitable for EFL cable crossing bridge. | |
| 1.3 | Conducting Field vane shear test at required locations:<br>a) Tamavua-i-wai<br>b) Wailekutu<br>And at depths 500mm below ground level including collection of disturbed soil samples at the test depth all complete as per specification and relevant standards. | |
| 1.4 | Conducting field CBR tests at required locations, including all complete including saturation as per specification and directions of the Engineer | |
| 1.5 | Conducting field Dynamic cone penetration (DCP) tests at required locations, and depth up to 3m or more as required, all complete including saturation as per specification and directions of the Engineer | |
| | Conducting various laboratory tests on soil samples at an approved laboratory including preparation of soil samples to determine the following properties of soil, preparation & submission of report of geotechnical investigation and foundation recommendation etc. all complete as per specification. | |

| | | |
|---|---|---|
| 1.6 | a) Natural Moisture content, bulk and dry density for UDS Samples<br>b) Sieve Analysis<br>c) Hydrometer or Pipette Analysis<br>d) Liquid Limit and Plastic Limit (Atterberg's Limits and plasticity index (LL, PL and PI)<br>e) Shrinkage Limit and shrinkage ratio<br>f) Specific gravity<br>g) Standard proctor compaction test<br>h) Unconfined Compressive strength test on undisturbed soil samples or soil samples compacted to specified density.<br>i) Direct Shear Test<br>j) Chemical Analysis of soil including sulphates, chlorides, ph value etc. | |
| 2.0 | Preparation and submission of report & Drawings as required. | |
| 3.0 | **Total Cost (VIP)** | |

15. Conclusion

The Geo-technical investigation shall provide valuable information and data to support the planning, design, and construction of the water crossing bridge project at Tamavua-i-wai and Wailekutu. By accurately analyzing the Geo-drilling data of the project area, the data will help mitigate risks, optimize design solutions, and ensure the successful implementation of the bridge construction project.

## TENDER CHECKLIST

***The Bidders must ensure that the details and documentation mention below must be submitted as part of their tender Bid***

Tender Number_____

Tender Name _____

1. Full Company / Business Name: _____

   **(Attach copy of Registration Certificate)**

2. Director/Owner(s): _____

3. Postal Address:_____

4. Phone Contact:_____

5. Fax Number:_____

6. Email address: _____

7. Office Location:_____

8. TIN Number:_____
   **(Attach copy of the VAT/TIN Registration Certificate - Local Bidders Only (Mandatory)**

9. FNPF Employer Registration Number: _____ **(For Local Bidders only) (Mandatory)**

10. **Provide a copy of Valid FNPF Compliance Certificate (Mandatory- Local Bidders only)**

11. **Provide a copy of Valid FRCS (Tax) Compliance Certificate (Mandatory Local Bidders only)**

12. **Provide a copy of Valid FNU Compliance Certificate (Mandatory Local Bidders only)**

13. Contact Person: _____

I declare that all the above information is correct.

Name: _____
Position: _____
Sign: _____
Date: _____

**Tender submission**

Bidders are requested to upload electronic copies via Tender Link by registering their interest at: https://www.tenderlink.com/efl

**This tender closes at 4.00pm (1600hrs) on Wednesday 04/09/2024**

For further information or clarification please contact our Supply Chain Office on phone **(+679) 3224360 or (+679) 9992400** or email us on tenders@efl.com.fj

**The bidders must ensure that their bid is inclusive of all Taxes payable under Fiji Income Tax Act.**

The lowest bid will not necessarily be accepted as the successful bid.

**The Tender Bids particularly the "Price" must be typed and not hand written.**

**Any request for the extension of the closing date must be addressed to EFL in writing three (3) working days prior to the tender closing date.**

**Tender Submission via email or fax will not be accepted.**