

REQUEST FOR PROPOSALS

GEOTECHNICAL FEASIBILITY STUDY FOR THE

EL DIQUIS HYDROELECTRIC POWER PROJECT

Submission Deadline: 10:00AM

LOCAL TIME

April 22, 2008

**Submission Place: Instituto Costarricense de Electricidad
Direccion de Proveeduría del ICE
Ventanilla Única del colegio los Angeles
Sabana Norte 300 Metros Norte,
San José, Costa Rica**

SEALED PROPOSALS SHALL BE CLEARLY MARKED AND RECEIVED PRIOR TO THE TIME AND DATE SPECIFIED ABOVE. PROPOSALS RECEIVED AFTER SAID TIME AND DATE WILL NOT BE ACCEPTED OR CONSIDERED.

REQUEST FOR PROPOSALS

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Section 1: INTRODUCTION

The U.S. Trade and Development Agency (USTDA) has provided a grant to fund the cost of goods and services required for a Geotechnical Feasibility Study (“Study”) on the El Diquis Hydroelectric Power Project for the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) (“Grantee”). The grant agreement is attached at Annex 4 for reference. The Grantee is soliciting technical proposals from qualified U.S. firms to provide expert consulting services to carry out the Feasibility Study.

1.1 BACKGROUND SUMMARY

In December 2001, the Central American countries signed the Plan Puebla-Panama (PPP) in an effort to integrate their electricity markets and transmission grids. This initiative was intended to increase security of supply, reduce the cost of electricity, and attract foreign investment. In the context of PPP, the Mesoamerican Energy Integration Program was formulated to include agreements from the Central American countries to create an electric interconnection system, the Central American Electric Interconnection System (SIEPAC). The Inter-American Development Bank (IDB) is currently funding the construction of this transmission grid as well as a series of projects that support further integration and development of the Central American energy market. While electricity sales are currently taking place cross-border throughout the region, the volume is expected to increase substantially once this grid is fully in service. The objective of development of additional generation resources like this Project is to facilitate the efficiency, transparency and competitiveness of the Central American regional power market.

The El Diquis hydroelectric power facility (Project) is one of the larger projects envisioned to contribute power to the SIEPAC grid and thereby help stabilize the energy shortages in Costa Rica and the Central American region. ICE launched a pre-feasibility study in 2004 for this Project with IDB funding. The focus of the first phase of the Feasibility Study was to evaluate the best location for harnessing the energy potential of the Grande de Térraba, Costa’s Rica’s largest river basin. The site deemed most effective was called “Boruca-Cajón.” Since phase one of the initial study was carried out, however, ICE conducted additional social outreach and environmental impact analysis until results determined that Baruca-Veraguas (El Diquis) was the most appropriate location. Data indicated that the hydrology at the Project site was favorable, and the proposed site had a good capacity factor and proportionately high firm energy production. The resulting Project is a 631 MW hydroelectric power plant on a reduced number of hectares, with a reduced impact on the indigenous populations and limited flooding of the surrounding territory.

While the precise location of the Project was defined, additional analysis remains which calls for a full-fledged Feasibility Study, valued at \$ 4 million, in order to move the Project toward implementation. ICE turned to the IDB and Central American Bank for Economic Integration (CABEI) as well as USTDA to complement their in-kind contributions to realize the full Feasibility Study for this Project. The following is a breakdown of the divisions of Feasibility Study funding requests:

IDB (\$1.5 million): Comprehensive environmental impact assessment; preliminary environmental impact assessment of the related transmission civil works; design and implementation of an interagency coordination body; panel of environmental experts;

ICE/CABEI (\$ 2 million): Engineering studies, design and technical specifications; environmental impact assessment of transmission line; administrative and logistical support; and

USTDA (\$500,000): Geotechnical analysis (solicited here) and the financial analysis (solicited separately).

A background Desk Study is provided for reference in Annex 2.

1.2 OBJECTIVE

The objective of this Project is to help increase the energy supply in Costa Rica and the Central American region while creating a more diversified energy sector that is sustainable, efficient, and competitive. After meeting Costa Rica's national electricity demands, ICE will contribute excess power generation to the regional electricity market via the transmission line of the SIEPAC.

The Terms of Reference (TOR) for this Feasibility Study is attached as Annex 5.

1.3 PROPOSALS TO BE SUBMITTED

Technical proposals are solicited from interested and qualified U.S. firms. The administrative and technical requirements as detailed throughout the Request for Proposals (RFP) will apply. Specific proposal format and content requirements are detailed in Section 3.

COST will not be a factor in the evaluation and therefore, cost proposals should not be submitted; upon detailed evaluation of technical proposals, one firm will be selected for contract negotiations. The amount for the negotiated contract has been established by a USTDA grant of U.S. \$300,000 dollars.

1.4 CONTRACT FUNDED BY USTDA

The negotiated contract will be funded by USTDA in accordance with the terms and conditions of its grant to the Grantee. The contract must include certain USTDA mandatory clauses relating to nationality, taxes, payment, reporting, and other matters. The USTDA nationality requirements and the USTDA mandatory clauses are attached at Annexes 3 and 4 for reference.

Section 2: INSTRUCTIONS TO PROPOSERS

2.1 PROJECT TITLE

The project is called "El Diquis Hydroelectric Power Project."

2.2 DEFINITIONS

Please note the following definitions of terms as used in this RFP.

The term "Request for Proposals" means this solicitation of a formal technical proposal including qualifications statement.

The term "Offeror" means the U.S. individual, or U.S. firm, including any and all subcontractors, which responds to the RFP and submits a formal proposal and which may or may not be successful in being awarded this procurement.

2.3 DESK STUDY REPORT

USTDA sponsored a Desk Study to address technical, financial, sociopolitical, environmental and other aspects of the proposed project. A copy of the Reports are attached at Annex 2 for background information only.

2.4 EXAMINATION OF DOCUMENTS

Offerors should carefully examine this RFP. It will be assumed that Offerors have done such inspection and that through examinations, inquiries and investigation they have become familiarized with local conditions and the nature of problems to be solved during the execution of the Feasibility Study.

Offerors shall address all items as specified in this RFP. Failure to adhere to this format may disqualify an Offeror from further consideration.

Submission of a proposal shall constitute evidence that the Offeror has made all the above mentioned examinations and investigations, and is free of any uncertainty with respect to conditions which would affect the execution, and completion of the Feasibility Study.

2.5 PROJECT FUNDING SOURCE

The Feasibility Study will be funded under a grant from USTDA. The total amount of the grant is not to exceed U.S. \$300,000 dollars.

2.6 RESPONSIBILITY FOR COSTS

Offeror shall be fully responsible for all costs incurred in the development and submission of the proposal or any other cost incurred by Offeror prior to issuance of an agreement or contract. Neither USTDA nor the Grantee assumes any contractual obligation as a result of the issuance of this proposal request, the preparation or submission of a proposal by an Offeror, the evaluation of proposals, or final selection.

2.7 TAXES

Offerors should submit proposals which note that in Annex 4, USTDA Mandatory Contract Provisions, USTDA funds are not to be used to pay taxes or duties under the laws of host country.

2.8 CONFIDENTIALITY

The Grantee will use its best efforts to preserve the confidentiality of any business proprietary or confidential information submitted by the Offeror, which is clearly designated as such by the Offeror.

2.9 ECONOMY OF PROPOSALS

Proposal documents should be prepared simply and economically, providing a comprehensive and concise description of the Offeror's capabilities to satisfy the requirements of the RFP. There is no necessity for expensive bindings, colored displays, or other promotional material unless such material is absolutely pertinent to the proposal. Emphasis should be placed on completeness and clarity of content.

2.10 SUBSTANTIVE PROPOSALS

The Offeror shall certify (a) that its proposal is genuine and is not made in the interest of, or on the behalf of, any undisclosed person, firm, or corporation, and is not submitted in conformity with, and agreement of, any undisclosed group, association, organization, or corporation; (b) that it has not directly or indirectly induced or solicited any other Offeror to put in a false proposal; (c) that it has not solicited or induced any other person, firm, or corporation to refrain from submitting a proposal; and (d) that it has not sought by collusion to obtain for himself any advantage over any other Offeror or over the Grantee or USTDA or any employee thereof.

2.11 CONDITIONS REQUIRED FOR PARTICIPATION

Only U.S. firms are eligible to participate in this tender. However, U.S. firms may utilize subcontractors from host country for up to 20 percent of the amount of the USTDA grant. USTDA nationality requirements are detailed in Annex 3.

2.12 LANGUAGE OF PROPOSAL

All proposal documents shall be prepared and submitted in English and Spanish.

2.13 PROPOSAL SUBMISSION REQUIREMENTS

The **Cover Letter** in the proposal must be addressed to:

Dirección de Proveeduría del ICE
Ventanilla única, del colegio los Angeles
Sabana Norte 300 metros norte
San José, Costa Rica
Phone: (506) 2205514
Fax: (506) 2326616

An Original in English an Original in Spanish and eight (8) copies in Spanish of your proposal must be received at the above address no later than 10:00 AM LOCAL TIME, on April 22, 2008.

Proposals may be either sent by mail, overnight courier, or hand-delivered. Whether the proposal is sent by mail, courier or hand-delivered, the Offeror shall be responsible for actual delivery of the proposal to the above address before the deadline. Any proposal received after the deadline will be returned unopened.

Upon timely receipt, all proposals become the property of the Grantee.

2.14 PACKAGING

Each proposal must be sealed to ensure confidentiality of the information. The proposals should be individually wrapped and sealed, and labeled for content including "original" or "copy number x"; the original in English and Spanish and eight (8) copies in Spanish should be collectively wrapped and sealed, and clearly marked for content.

Neither USTDA nor the Grantee will be responsible for premature opening of proposals not properly labeled.

2.15 AUTHORIZED SIGNATURE

The proposal must contain the signature of a duly authorized officer or agent of the Offeror empowered with the right to bind the Offeror.

2.16 EFFECTIVE PERIOD OF PROPOSAL

The proposal shall be binding upon the Offeror for sixty (60) days after the proposal due date, and Offeror may withdraw or modify this proposal at any time prior to the due date upon written request, signed in the same manner and by the same person who signed the original proposal.

2.17 EXCEPTIONS

Firms agree by their response to the RFP announcement to abide by the procedures set forth therein. Material modifications in the TOR or responsibilities of the parties will not be accepted.

Any exceptions in the proposal shall be clearly identified, and shall include the scope of such exception, and its impact, on the procurement. The Grantee shall make final determination as to the responsiveness of such exceptions and their acceptability.

2.18 OFFEROR QUALIFICATIONS

As provided in Section 3, Offerors shall submit evidence that they have relevant past experience and have previously delivered advisory and Feasibility Study services similar to those required in the TOR.

2.19 RIGHT TO REJECT PROPOSALS

The Grantee reserves the right to reject any and all proposals and to accept or reject any or all of the items in the proposal, and to award the contract in whole or in part if it is deemed in the best interest of the Grantee.

2.20 PRIME CONTRACTOR RESPONSIBILITY

Offerors have the option of subcontracting parts of the services they propose. The Offeror's proposal must include a description of any anticipated subcontracting arrangements, including the name, address, and qualifications of consultants and subcontractors. USTDA nationality provisions are set forth in detail in Annex 3. The successful Offeror shall cause appropriate provisions of its contract, including all mandatory USTDA clauses, to be inserted in all subcontracts ensuing to ensure fulfillment of all contractual provisions by subcontractors.

2.21 AWARD

An award resulting from this RFP shall be made to the best qualified Offeror, taking into consideration the evaluation factors set forth herein; however, the right is reserved to reject any and all proposals received and, in all cases, the Grantee will be the judge as to whether a proposal has or has not satisfactorily met the requirements of this RFP.

2.22 COMPLETE SERVICES

The successful Offeror shall be required to (a) furnish all supplies, supervision, transportation, and other execution accessories, services, and facilities; (b) provide and perform all necessary labor; and (c) in accordance with good technical practice, with due diligence, and in accordance with the requirements, stipulations, provisions and conditions of this RFP and the resultant contract, execute and complete all specified work to the satisfaction of the Grantee.

2.23 INVOICING AND PAYMENT

Deliverables under the contract shall be delivered on a schedule to be agreed upon in a contract with the Grantee. The Contractor may submit invoices to the designated Grantee Project Director in accordance with a schedule to be negotiated and included in the contract. Upon approval of each invoice, the Grantee will forward the invoice to USTDA which will process payment to the Contractor. All payments by USTDA under the Grant Agreement will be made in U.S. currency.

In consideration for the Consultant's performance of the Study, the Grantee shall arrange for the Grant Funds to be disbursed by USTDA directly to the Consultant as follows:

- (1) US\$15,000 (5%) at the completion of Task 1;
- (2) US\$210,000 (70%) at the completion of Tasks 2 and 3;
- (3) US\$30,000 (10%) at the completion of Tasks 4 and 5;
- (4) US\$45,000 (15%) upon receipt by USTDA of an approved Final Report in accordance with the specifications and quantities set forth in Clause I of the Mandatory Clauses.

Section 3: PROPOSAL FORMAT AND CONTENT

To expedite proposal review and evaluation, and to assure that each proposal receives the same orderly review, all proposals must follow the format described in this section.

Proposal sections and pages shall be appropriately numbered and the proposal shall include a Table of Contents. Offerors are encouraged to submit concise and clear responses to the RFP. Proposals shall contain all elements of information requested without exception. Instructions regarding the required scope and content are given in this section. The Grantee reserves the right to include any part of the selected proposal in the final contract.

The proposal shall consist of a technical proposal only. No cost proposal is required as the value of the USTDA grant is established at U.S. \$300,000 dollars.

Offerors shall submit one (1) original in English and one (1) original in Spanish and eight (8) copies in Spanish of the proposal. Proposals received by fax cannot be accepted.

The following sections and content are required for each proposal:

- Transmittal Letter,
- Cover/Title Page,
- Table of Contents,
- Introduction and Executive Summary,
- Company Information,
- Organizational Structure, Management Plan, and Key Personnel,
- Technical Approach and Work Plan,
- Experience and Qualifications, and
- Miscellaneous.

Detailed requirements and directions for the preparation of each section are presented below.

3.1 SECTION 1: INTRODUCTION AND EXECUTIVE SUMMARY

An Executive Summary should be prepared describing the major facts or features of the proposal, including any conclusions, assumptions, and generalized recommendations the Offeror desires to make. Offerors are requested to make every effort to limit the length of the Executive Summary to no more than five (5) pages.

3.2 SECTION 2: COMPANY INFORMATION

3.2.1 Company Profile

Provide the information listed below relative to the Offeror's firm. If the Offeror is proposing to subcontract some of the proposed work to another firm(s), similar information must be provided for each subcontractor. Offerors are requested to limit the length of the Company Profile Information to one (1) page per firm.

1. Name of firm and business address, including telephone and fax numbers.
2. Year established (include former firm names and year established, if applicable).
3. Type of ownership and parent company, if any.
4. Project Manager's name, address, telephone and fax number, if different from (1).

3.2.2 Offeror's Authorized Negotiator

Provide name, title, address, telephone and fax number of the Offeror's authorized negotiator. The person cited shall be empowered to make binding commitments for the Offeror and its subcontractors, if any.

3.2.3 Negotiation Prerequisites

1. Discuss any impact of any current or anticipated commitments which may impact the ability of the Offeror or its subcontractors to complete the Feasibility Study as proposed and within the project schedule.
2. Identify any specific information which is needed from the Grantee before commencing contract negotiations.

3.3 SECTION 3: ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND KEY PERSONNEL

Describe the Offeror's proposed project organizational structure. Discuss how the project will be managed including the principal and key staff assignments for this Feasibility Study. Identify the Project Manager who will be the individual responsible for this project. The Project Manager must have the responsibility and authority to act on behalf of the Offeror in matters related to the proposed Feasibility Study.

Provide a listing of personnel (including subcontractors and consultants) to be engaged in the project, either U.S. or local with the following information for key staff: position in the project; pertinent experience, curriculum vitae; other relevant information. If subcontractors are to be used, the organizational relationship between the firms must be described.

A manpower schedule and the level of effort for the project period, by activities and tasks, as detailed under the Work Plan shall be submitted. A statement confirming the availability of the proposed project manager and key staff over the duration of the project must be included in the proposal.

3.4 SECTION 4: TECHNICAL APPROACH AND WORK PLAN

Describe in detail the proposed technical approach and work plan. Discuss the project requirements as perceived by the Offeror. Include a brief narrative of tasks within each activity series. Begin with the information gathering phase and continue through delivery and approval of all required reports.

Prepare a detailed schedule of performance that describes all activities and tasks within the Technical Work Plan, including periodic reporting or review points, incremental delivery dates, and other project milestones.

Based on the Technical Work Plan, and previous project experience, explain when and where Offeror will require support from the Grantee. Detail the amount of staff time required by the Grantee or participating agencies and any work space or facilities needed to complete the Feasibility Study.

3.5 SECTION 5: EXPERIENCE AND QUALIFICATIONS

Provide a discussion of the Offeror's experience and qualifications which are relevant to the objectives and TOR for the Feasibility Study. If a subcontractor(s) is being used, similar information must be provided for the prime and each subcontractor firm proposed for the project. Relevant experience and qualifications of key staff proposed shall be provided including letters of commitment from the individuals proposed concerning their availability for contract performance.

For each individual proposed, the Offeror must provide evidence (preferably letters of recommendation signed by current or former clients) clearly demonstrating the qualifications of such individuals in the following areas:

- Drilling experiences for depths of up to, and exceeding 500 meters
- Hydraulic fracturing tests experiences in perforations of up to, and exceeding, 500 meters
- Experience in Geophysical exploration by seismic reflection, in perforations of up to, and exceeding 500 meters

As many as possible but not more than six (6) relevant and verifiable project references must be provided, including the following information:

Project name,
Name and address of client (indicate if joint venture),
Client contact person (name/ position/ current phone and fax numbers),
Period of Contract,

Description of services provided,
Dollar amount of Contract, and
Status and comments.

Offerors are strongly encouraged to include in their experience summary primarily those projects that are similar to or larger in scope than the Feasibility Study as described in this RFP.

Section 4: AWARD CRITERIA

Individual proposals will be initially evaluated by a Procurement Selection Committee of representatives from the Grantee. The Committee will then conduct a final evaluation and completion of ranking of qualified Offerors, and the Grantee shall promptly negotiate a contract with the best qualified Offeror. If a satisfactory contract cannot be negotiated with the best qualified Offeror, negotiations will be formally terminated. Negotiations shall then be undertaken with the second most qualified Offeror and so forth.

Offerors are requested to nominate an engineer, and one or more alternates, responsible for carrying out testing described in the Terms of Reference and include curriculums vitae for those individuals.

Offers are requested to provide brief descriptions of geotechnical fieldwork experience and software applications used for geotechnical testing.

The selection of the Contractor will be based on the following criteria:

Industry Experience (20 points maximum)

Quantity of perforations exceeding depths of 500 meters

(A minimum of five (5) such perforations are required for eligibility)

Five (5) to seven (7) perforations exceeding depths of 500 meters: Three (3) points

Seven (8) to ten (10) perforations exceeding depths of 500 meters: Five (5) points

More than ten (10) perforations exceeding depths of 500 meters: Ten (10) points

Quantity of Hydraulic Fracturing Tests carried out, analyzed, and interpreted in perforations exceeding depths of 500m

(A minimum of ten (10) such experiences are required for eligibility)

Ten (10) to 50

Three (3) points

51 to One-hundred (100)

Five (5) points

More than one-hundred (100)

Ten (10) points

Technical Approach and Work Plan (35 points maximum)

(Submission is required for eligibility)

Project plan with description of activities and timetables:

Fifteen (15) points

Proposed training, training topics and durations:

Ten (10) points

Complementary hydraulic fracturing and seismic reflection analysis software: Ten (10) points

Technical Background and Qualifications (45 points maximum)

Academic degree of the Director of Geotechnical studies (Specifically in the execution of deep perforations and hydraulic fracturing tests)

Licensed or Chartered	Five (5) points
Bachelor Degree from a Four year University	Five (5) points
Master's Degree	Ten (10) points
Doctorate (PhD)	Fifteen (15) points

Project Manager's Proficiency in Spanish

Able to read (fully understand written Spanish):	Three (3) points
Able to read and write (full communication in written Spanish):	Five (5) points
Able to read, write and speak (Fluent in Spanish)	Ten (10) points

Drill master's experience in perforations exceeding depths of 500 meters
(A minimum of five (5) years of experience is required for eligibility)

Five (5) to Ten (10) years of experience:	Three (3) points
Eleven (11) to 15 years of experience:	Five (5) points
More than 15 years of experience:	Ten (10) points

Technician's experience in small diameter perforations with diamond rotating bit, and core recovery

(A minimum of five (5) years of experience is required for eligibility)

Five (5) to Ten (10) years of experience:	Three (3) points
Eleven (11) to 15 years of experience:	Five (5) points
More than 15 years of experience:	Ten (10) points

Proposals which do not include all requested information may be considered non-responsive.

Price will not be a factor in contractor selection.

Note: Minimum acceptance qualification value for any offeror is 60 points

ANNEX 1

Instituto Costarricense de Electricidad, Dirección de Proveeduría del Ice, Mr. José Manuel Lopez Pinto, Ventanilla Única del colegio los Angeles, Sabana Norte 300 Metros Norte, San José, Costa Rica, Phone: (506) 2205514, Fax (506) 2326616

B – COSTA RICA – GEOTECHNICAL FEASIBILITY STUDY FOR THE EL DIQUIS HYDROELECTRIC POWER PROJECT

POC Evangela Kunene, USTDA, 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901, Tel: (703) 875-4357, Fax: (703) 875-4009. Geotechnical Feasibility Study For The El Diquis Hydroelectric Power Project. The Grantee invites submission of qualifications and proposal data (collectively referred to as the "Proposal") from interested U.S. firms which are qualified on the basis of experience and capability to develop a financial feasibility study for the El Diquis Hydroelectric Power Project.

The Government of Costa Rica and its national electric utility, Instituto Costarricense de Electricidad (ICE), are committed to developing a reliable and economic supply of power for Costa Rica and to providing additional generating capacity to the regional Central American Electric Interconnection System (SIEPAC) grid.

The El Diquís hydroelectric power facility (Project) is one of the larger projects envisioned to contribute power to the SIEPAC grid and thereby help stabilize the energy shortages in Costa Rica and the Central American region. ICE launched a pre-feasibility study in 2004 for this Project with Inter-American Development Bank funding. The focus of the first phase of the feasibility study was to evaluate the best location for harnessing the energy potential of the Grande de Térraba, Costa's Rica's largest river basin. The site deemed most effective was called "Boruca-Cajón." Since phase one of the initial study was carried out, however, ICE conducted additional social outreach and environmental impact analysis until results determined that Baruca-Veraguas (El Diquís) was the most appropriate location. Data indicated that the hydrology at the Project site was favorable, and the proposed site had a good capacity factor and proportionately high firm energy production. The resulting Project is a 631 MW hydroelectric power plant.

While the precise location of the Project was defined, additional analysis remains which calls for a full-fledged feasibility study, valued at \$4 million, in order to move the Project toward implementation. ICE turned to the IDB and Central American Bank for Economic Integration as well as the U.S. Trade and Development Agency (USTDA) to complement their in-kind contributions to realize the full feasibility study for this Project. USTDA is providing funds for a comprehensive financial analysis feasibility study.

The U.S. firm selected will be paid in U.S. dollars from a \$300,000 grant to the Grantee from the U.S. Trade and Development Agency.

A detailed Request for Proposals (RFP), which includes requirements for the Proposal, the Terms of Reference, and a background desk study report are available from USTDA, at 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901. To request the RFP in PDF format, please go to: <https://www.ustda.gov/USTDA/FedBizOpps/RFP/rfpform.asp>. Requests for a mailed hardcopy version of the RFP may also be faxed to the IRC, USTDA at 703-875-4009. In the fax, please include your firm's name, contact person, address, and

telephone number. Some firms have found that RFP materials sent by U.S. mail do not reach them in time for preparation of an adequate response. Firms that want USTDA to use an overnight delivery service should include the name of the delivery service and your firm's account number in the request for the RFP. Firms that want to send a courier to USTDA to retrieve the RFP should allow one hour after faxing the request to USTDA before scheduling a pick-up. Please note that no telephone requests for the RFP will be honored. Please check your internal fax verification receipt. Because of the large number of RFP requests, USTDA cannot respond to requests for fax verification. Requests for RFPs received before 4:00 PM will be mailed the same day. Requests received after 4:00 PM will be mailed the following day. Please check with your courier and/or mail room before calling USTDA.

Only U.S. firms and individuals may bid on this USTDA financed activity. Interested firms, their subcontractors and employees of all participants must qualify under USTDA's nationality requirements as of the due date for submission of qualifications and proposals and, if selected to carry out the USTDA-financed activity, must continue to meet such requirements throughout the duration of the USTDA-financed activity. All goods and services to be provided by the selected firm shall have their nationality, source and origin in the U.S. or host country. The U.S. firm may use subcontractors from the host country for up to 20 percent of the USTDA grant amount. Details of USTDA's nationality requirements and mandatory contract clauses are also included in the RFP.

Interested U.S. firms should submit their Proposal in English and Spanish directly to the Grantee by **10:00 AM LOCAL TIME on April 22, 2008** at the above address. Evaluation criteria for the Proposal are included in the RFP. Price will not be a factor in contractor selection, and therefore, cost proposals should NOT be submitted. The Grantee reserves the right to reject any and/or all Proposals. The Grantee also reserves the right to contract with the selected firm for subsequent work related to the project. The Grantee is not bound to pay for any costs associated with the preparation and submission of Proposals.

ANNEX 2

FINAL REPORT

DESK STUDY

FOR THE

EL DIQUÍS HYDROELECTRIC PROJECT IN COSTA RICA

USTDA 2007-51009A

Submitted to

**U.S. Trade and Development Agency
Washington, D.C. 20523-1602**

By

**COMMONWEALTH POWER CORPORATION
Norfolk, Virginia 23502**

R. Peter Lalor

August 9, 2007

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SECTION A

EXECUTIVE SUMMARY

Commonwealth Power Corporation (Consultant) was awarded Contract 2007-51009A by the U.S. Trade and Development Agency (USTDA) to carry out a Desk Study (DS) review of the request for Feasibility Study (FS) by the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) for the 630 MW El Diquís hydroelectric project (Project) on the Grande de Térraba River in Costa Rica, to determine whether it meets the USTDA funding requirements. To qualify for funding, a project must:

- be a national development priority;
- have significant U.S. export potential;
- be economically viable and likely to be developed and financed; and
- have significant competition in relevant product markets from suppliers outside the U.S.

Consultant has assessed the Project proposal in light of USTDA's core project evaluation criteria, including developmental impact measures, U.S. export potential, likelihood of financing and implementation, foreign competition, environmental impact, and impact on US labor.

The Project would increase the energy supply in Costa Rica and the Central American region and thus make the region's electric sector or more sustainable, efficient, and competitive. A significant amount of feasibility study-level work has already been completed and confirms the likely economic viability of the Project; the principal remaining FS effort is related to preparation of specifications, environmental impact studies, supplemental geotechnical studies and studies related to practicable financial structures. The total cost of the remaining FS work, plus some additional efforts such as establishing a panel of environmental experts and an inter-institutional coordinating body, is valued at \$4,041,000. The Inter-American Development Bank (IDB) is contributing \$1.5 million, ICE is contributing \$664,000 of in-kind services, and the Central American Bank for Economic Integration (CABEI) is contributing approximately \$1.38 million. ICE has requested that USTDA provide the remaining \$500,000 of required funding support: \$300,000 for the supplemental geotechnical studies component, and \$200,000 for the financial structuring studies component. This DS addresses the request for support of both the geotechnical and financial portions of the FS for a total amount of \$500,000.

The Project as it was initially conceived was both larger in scope and more expensive (on a unit-price basis) than the revised, scaled-down version that was developed by ICE and its consultants over the 2004 – 2005 timeframe. The revised plan, which is the subject of this DS has two principal benefits compared to the earlier plan: the social impacts and environmental impacts have been greatly reduced; and, the unit costs of the Project have been reduced by roughly 25% (from approximately \$2 million per installed megawatt to \$1.5 million per installed megawatt), making the revised Project substantially more financeable than the earlier version. The construction cost of the Project (without financing charges) is very attractive at \$1 million per installed megawatt. However, the construction period of 8 years results in relatively high finance costs during construction, even with the current low cost of capital prevailing in the international capital markets.

Consultant investigated the technical and economic viability of the Project as well as the financial, legal, regulatory and institutional considerations affecting hydroelectric power projects in Costa Rica, and has determined that the Project is economically viable and likely to be financed and implemented, and otherwise meets the USTDA funding requirements.

Consultant concluded that the Project revenues appear to have been conservatively estimated; in particular, the Project's ability to store flows and release them on a peaking basis should substantially enhance its value during the dry season and drought conditions. Consultant believes the associated benefits will outweigh the burden of market pressure during periods of hydrologic excess. Moreover, the dynamics that underpin the current high cost of generating power in the region are unlikely to change with the implementation of market systems, particularly as global fossil fuel prices appear to be stabilizing at relatively high levels. Accordingly, we believe that a decline in the real price of energy is unlikely, and it appears that this Project will be viable, even in a flat price environment.

The principal considerations other than likely economic viability that make the Project an attractive candidate for USTDA assistance are listed below, and a more detailed list of attractive Project attributes is given in Section B-3.

Developmental Impact

The Government of Costa Rica and its national electric utility, ICE, are committed to a reliable and economic supply of power to the Costa Rican grid. This Project would unquestionably serve that purpose, and thus provide direct and important benefits to the people of Costa Rica. In addition, the Project is located in an area that is generally impoverished and not well-served by the electric system, and the Project would support economic development and the provision of reliable service to the local community, as well as the rest of the nation and the Central American region. Finally, it would also facilitate the evolution of regional markets for power: the offtake capability of the soon-to-be-inaugurated grid of the Sistema de Interconexión Eléctrica de Países de América Central (SIEPAC) grid will allow the benefits of the project to be realized at a regional level. It is hoped that the SIEPAC structure will also permit binding financial commitments from consumers in the region that will help in the realization of the Project itself, and in any event it is the sponsor's intention to sell excess available energy throughout the Central American region via the SIEPAC grid.

Export Potential

The Project is large in scale, with a total engineering and construction cost of more than \$900 million, and US vendors should be competitive for approximately \$300 million of that amount.

Degree of Geologic and Hydrologic Certainty

The geology and hydrology at the site have been studied in adequate detail to conclude that the Project justifies further, more detailed investigations, and the hydrology in particular has been very well characterized for a project at this stage.

We have therefore concluded that the Project merits USTDA support and recommend that USTDA support both the U.S. \$200,000 of the financial structuring component of the FS and the U.S. \$300,000 to carry out the geotechnical component of the FS for the Project.

SECTION B

PROJECT BACKGROUND, DESCRIPTION AND ASSESSMENT

1. PROJECT BACKGROUND

A. General

While there has been some limited success in developing new, large hydroelectric projects in Latin America and elsewhere in the world over the past few decades, the vast majority of new capacity added during that time has been thermal generation fueled by (nonrenewable) fossil energy sources. The preference for fossil-fueled thermal plants is, in most cases, readily explained. When compared to hydroelectric projects of comparable size, thermal projects can be constructed more quickly, with less risk—both at a construction and operational level. The availability and cost of capital for thermal projects is correspondingly better. The fact that financing costs have been relatively high for hydroelectric projects has a particularly large impact, as the projects are typically very capital-intensive compared to thermal projects. Finally, costs of fossil fuels in both spot and futures markets has traditionally exhibited some volatility, but has generally been low compared to the cost of capital for renewable energy projects.

Central America has the disadvantage of having few indigenous natural resources suitable for energy production. While in some regions there is significant hydroelectric potential, and in other regions there is geothermal potential, there are practically no reserves of natural gas, crude oil, or coal, so Central America is dependent on external resources for its fossil fuel needs. Moreover, the transportation and handling costs for the delivery of fossil fuels to Central American power stations is substantial and results in a major comparative cost disadvantage for the region.

However, over the past two years oil and coal markets have seen significant price increases that have substantially eroded the relative attractiveness of fossil-fueled thermal generation. Moreover, the cost of long-term equity and debt capital on international markets has reached, and stabilized at, historically low levels; this provides a significant benefit to capital-intensive projects. As Costa Rica has substantial untapped hydroelectric potential, and as indigenous energy resources are scarce in Central America and therefore at a premium, Costa Rica appears to have an unusually attractive opportunity to take advantage of natural resources to provide itself and its neighbors with the benefits of a clean, reliable and relatively inexpensive long-term energy source. To the extent that emissions trading or other mechanisms are ultimately put in place to discourage fossil fuel consumption, the benefits of indigenous, renewable energy resources will be even greater.

Beginning in February of 2004, ICE awarded a series of contracts for evaluation of various options for harnessing the potential of the Térraba basin. The work was originally geared toward a conventional design study, but it was modified to determine practicable structure for project execution that fully take into account the Project's social and environmental context as well as its technical and economic aspects.

The Project as currently configured offers several evident advantages: is situated in the south, in Costa Rica's largest watershed and in one of the country's least developed areas and therefore offers both a cost-effective natural resource and the potential to catalyze socioeconomic growth in the southern part of the country. It also complements regional electric integration by facilitating regional electricity trade and competitiveness through potential savings and lower prices in the

region. The Indicative Regional Generation Expansion Plan 2005 – 2019 prepared by the Central American Electrification Council's Regional Indicative Planning Working Group identifies capital and operations-related savings to the regional electric market of US \$157 million to US\$170 million, with a drop in long-term marginal costs of from US\$1.8/megawatt hour to US\$3.5/megawatt hour as a result of the development of large-scale hydroelectric projects.

B. Need for Additional Generating Capacity

Costa Rica is a country with a population over four million. The country has experienced rapid economic growth, of approximately 4% per year, and growth in electrical demand, in the 5-6% per year range, over the past five years. Growth at that rate is expected to continue for the indefinite future.¹ The nation has recently (mid-April through the first week of May, 2007) faced power shortages as a result of low rainfall and correspondingly low reservoir levels. The Project is not scheduled to come on line until approximately 2016, and so would not address the near-term need for additional energy supplies. The recent shortages are nevertheless an indication of the current deficiency.

ICE has the primary responsibility for the production, transmission and distribution, of electricity in Costa Rica. It has an interconnected national network of 230 kV transmission lines extending to most of Costa Rica. From that network, subtransmission and distribution lines supply electricity to most of the people in the country. However, there are still communities not well served by the grid. Portions of the Rio Térraba basin, for instance, are economically less developed and do not receive reliable electrical service.

In addition, the Central American region is in the process of establishing a substantially enhanced interconnection, and the electric sectors in most Central American countries are undergoing some degree of privatization. Electricity sales are taking place cross-border throughout the region, and are expected to increase substantially as interconnection facilities currently under construction are placed in service. The development of additional generation resources will facilitate the evolution of markets, and the associated efficiencies and transparency.

2. PROJECT DESCRIPTION

Catchment Statistics. The catchment area above the dam would be 2540 km², with average annual rainfall of 2277 mm/year. The average flow at the damsite is 167 m³/second, and the Probable Maximum Flood is estimated at 22,300 m³/sec, with a total volume of 1987 hm³.

Dam. The dam would be a concrete-faced, rockfill gravity dam. The crest of the dam would be at El 310 m, ten meters above the normal maximum pool of 300 m msl. The maximum height would be 170 m above the natural river channel. The crest length would be 600 m, and the estimated volume of material in the dam would be 12,680,000 m³. The spillway would have a discharge capacity of 13,933 m³/s.

Reservoir. The reservoir would cover an area of 6190 hectares, and have a live storage of 1646 hm³ between the operating limits of El 300 m and El 260 m. Inactive storage below El 260 m is

¹ The Costa Rican electric system has a current peak demand (2005) of 1390 MW and installed generating capacity of 1960 MW, with a total annual production (2005) of 8146 GWh. Of those figures, hydro accounts for 1300 MW and 6560 GWh, thermal for 420 MW and 300 GWh, geothermal for 165 MW and 1100 GWh, and wind for 68 MW and 200 GWh. The comparable figures for Central America as a whole are: peak demand of 5952 MW; aggregate installed capacity of 9065 MW and production of 34,518 GWh; hydro 3880 MW and 17,050 GWh; thermal 4690 MW and 14,820 GWh; geothermal 427 MW and 2445 GWh; and wind 69 MW and 204 GWh.

1212 hm³, and would be used to contain the sediment inflow estimated at 3.6 million tons per year.

Powerhouse. The powerhouse would be subterranean, and as currently conceived would consist of four Francis units, each with 92% efficiency and an output of 147 MW while operating at full gate under a rated net head of 254 m. The turbine discharge capacity at the rated net head would be 64.3 m³/s. The generators would be 24-pole, 300 rpm units with 13.8 kV output, rated a 169 MVA and 98.5% efficiency, and would feed three monophase 13.8/230 kV transformers with 10% impedance. In addition, a small generating unit of 23 MW with a design discharge capacity of about 18 m³/s would be incorporated into the design of the dam for meeting minimum release requirements. Water would be released through this unit on a more or less continuous basis. The projected annual generation from the main powerhouse is projected at 2869 GWh and that from the bypass flow at 181 GWh, for a total projected generation of 3050 GWh per year.

A 230 kV switchyard would be constructed adjacent to the powerhouse area. The switchyard would contain circuit breakers, a takeoff structure, disconnect switches, surge arresters, a power-line carrier transmitter/receiver, and all associated substation hardware for interconnection with the national and regional grids.

3. PROJECT ASSESSMENT

The Project is in a relatively late stage of development, and there is sufficient information to conclude that the proposal has substantial merit. A great deal of work has already been performed by ICE characterizing the Project's geology, hydrology, and economics.

The hydrologic studies benefit from the location of a long-term flow gauging station near the proposed dam site, from extensive hydrometeorological records throughout the drainage basin, and from the application of sophisticated hydrologic modeling algorithms in recent, prior studies.

ICE has also completed comprehensive geotechnical studies, and as a result the Project has materially less construction uncertainty than a typical development-stage hydro project. However, further geophysical and geotechnical studies to confirm and expand on the results of the prior investigations will be necessary to characterize Project construction costs to within a range of $\pm 10\%$. Support for those studies is the subject of a portion of this DS.

ICE has undertaken extensive economic studies of the Project, which have been supported by both the hydrologic modeling noted above and by application of a complex electric system production model. Further economic and financial studies will be necessary to refine the results of the prior studies, to identify preferred financing structures for the Project, and to evaluate competing offers from prospective project partners. Support for those studies is also the subject of a portion of this DS.

In our investigations on whether the Project is likely to be economically justified, we concluded that Project revenues appear to have been conservatively estimated; in particular, the Project's ability to store flows and release them on a peaking basis should substantially enhance its value during the dry season and drought conditions. We believe the associated benefits will outweigh the burden of market pressure during periods of hydrologic excess. Moreover, the dynamics that underpin the current high cost of generating power in the region are unlikely to change with the implementation of market systems, particularly as global fossil fuel prices appear to be stabilizing at relatively high levels. Accordingly, we believe that a decline in the real price of energy is unlikely, and it appears that this Project will be viable, even in a flat price environment.

Consultant investigated the technical and economic viability of the Project as well as the financial², legal, regulatory and institutional considerations affecting independent power projects in Costa Rica. Consultant has determined that the Project meets the USTDA funding requirements. The primary considerations other than likely economic viability that make the Project an attractive candidate for USTDA Grant assistance are as follows.

Developmental Impact

The goal of the Government of Costa Rica (GOCR) and its national electric utility, ICE, is the reliable and economic supply of power to the Costa Rican grid. This Project would unquestionably serve that purpose, and provide direct and important benefits to the people of Costa Rica. In addition, the Project is located in an area that is generally impoverished and not well-served by the electric system, and the Project would support economic development and the provision of reliable service to the local community, as well as the rest of the nation and the Central American region. It would also facilitate the evolution of regional markets for power: the offtake capability of the soon-to-be-inaugurated SIEPAC grid will allow the benefits of the project to be realized at a regional level. It is hoped that the SIEPAC structure will also permit binding financial commitments from consumers in the region that will help in the realization of the Project itself, and in any event it is the sponsor's intention to sell excess available energy throughout the Central American region via the SIEPAC grid.

Export Potential

The Project is large in scale, with a total engineering and construction cost of more than \$900 million, and US vendors should be competitive for approximately \$300 of that amount.

Degree of Geologic and Hydrologic Certainty

The sponsors have performed a substantial amount of study work to reduce the risks normally associated with hydro development. The geology and hydrology at the site have been studied in adequate detail to conclude that the Project justifies further, more detailed investigations, and the hydrology in particular has been very well characterized for a project at this stage.

Additional attractive attributes of the project are as follows.

- By the time this Project goes into operation, Costa Rica will be part of an integrated Central American grid. The region is already suffering from a power deficit during moderate drought conditions, and will need significant amounts of new power to supply the growing needs of the region. Data indicate that the hydrology at the Project site is favorable, and the proposed Project has a good capacity factor and proportionately high firm energy production. Moreover, the addition of new capacity will facilitate the development of power markets at a regional level, with associated efficiencies and transparency.
- In general, the initial capital cost estimates (with interest during construction included) and the development budget appear to be comprehensive and credible (although uncertainty remains with regard to foundation rock conditions), and include the cost of necessary transmission works.

² In performing our evaluations of Project prospects, we have evaluated the Project using a conventional 70/30 debt/equity structure and assumed capital market conditions roughly the same as those currently prevailing, in order to assess a cost of capital for use in our preliminary financial evaluation. In general, the usual factors which lenders and capital market participants will look to in assessing Project and sub-investment grade country risk profiles are favorable.

- The capital cost estimates indicate a Project with a rather attractive capital cost. The Project has a projected all-in cost of almost \$1,500 per kW, which is relatively economic, and a construction only cost of \$1 million per MW, which is very competitive. The Project must be competitive with other new entrants in the Central American market, and the Project is at the lower end of the range where, given current fuel pricing and capital markets equilibrium, it should be competitive. Financing for a project with that level of installed cost should be possible during "windows" of unusually favorable conditions in the capital markets, such as are currently in place.
- There are limited environmental and social impacts associated with the inundation of reservoir areas.
- The Project appears well located from a transmission point of view. Consultant has reviewed available system maps and diagrams, and believes that the Project is unlikely to cause stability concerns and is unlikely to create load flow complications.

SECTION C

PROJECT SPONSOR'S CAPABILITIES AND COMMITMENT

The Project's sponsor, ICE, is an organization with strong capabilities in electric power planning, design and operation. It has the primary responsibility for the production, transmission and distribution, of electricity in Costa Rica. ICE has extensive experience and full expertise in the management of engineering, environmental and economic studies, and in the construction and operation of hydroelectric power projects. It unquestionably has the institutional capacity to undertake all of its commitments in connection with this project. It also unquestionably has the motivation to do so; there is strong interest on the part of both the Government of Costa Rica and ICE to move forward with this Project, given the recent cancellation of a large geothermal project in Costa Rica, growth in annual energy demand of approximately 6%, and recent shortages and power rationing throughout the country.

The only question relevant to ICE's capabilities is related to its financial ability to sponsor the entire project, the output from which substantially exceeds Costa Rica's near-term needs. That is uncertain; it is likely that some sort of public-private partnership, with contribution of private capital to construction funding, will be required. That issue will be addressed by one of the two studies for which USTDA support has been requested.

SECTION D

IMPLEMENTATION FINANCING

The projected level of investment for this Project is approximately \$930,000,000. At this stage, it is not possible to predict the likely financing structure that will ultimately be used by the Project. That structure will be dependent on the ownership / partnership / concession structure ultimately decided on by ICE and the Government, and of course by conditions in the capital markets at the time of financing; recommendations on preferred financing structures are the subject of one of the studies for which USTDA funding has been requested.

The principal funding agency for the Project studies is expected to be the IDB, through the Forum for the Financing of Technical Cooperation for Initiatives for Regional Infrastructure Integration (FIRII), with the expectation that IDB will finance a significant part of full project implementation. Consultant has confirmed that financing is likely to be available from the IDB and other sources, and has made an assessment of ICE's intentions for the implementation financing.

It is also likely that U.S. Overseas Private Investment Corporation (OPIC) and/or the U.S. Export-Import Bank (Ex-Im) will be involved in project financing if U.S. vendors are successful. OPIC provides medium to long-term financing in the form of investment guarantees and direct loans to projects with at least 25 percent U.S. investor equity. In addition, it offers political risk insurance that protects against expropriation, political violence and inconvertibility. Ex-Im also offers a wide range of guarantees, insurance and financing to U.S. exporters. Machinery and other capital goods exports to Costa Rica may be financed at low rates and long terms through special credit lines offered by such export credit agencies.

The total cost of the remaining FS work is valued at \$4,041,000. The IDB is contributing \$1.5 million, ICE is contributing \$664,000 of in-kind services, and CABEL is contributing approximately \$1.38 million, to carry out portions of the basic design and technical specifications, perform socio-environmental analysis and environmental impact studies, and to establish a panel of experts and a body for inter-institutional coordination. ICE has requested that USTDA fund the remaining \$500,000 to identify preferred practicable financial structures and to carry out supplemental geotechnical studies.

SECTION E

U.S. EXPORT POTENTIAL

In the past, U.S. vendors of hydroelectric equipment have had at best limited success in penetrating foreign markets. However, the recent decline in the US Dollar should greatly enhance prospects for US exports.

The estimated construction cost for the Project is as follows:

	US \$
Mobilization & Infrastructure	10,000,000
Environmental Protection and Social Budget	84,120,000
Dam, Diversion and Appurtenances	247,600,000
Conveyance Facilities	133,510,000
Powerhouse and Discharge	73,010,000
Electromechanical Equipment	213,270,000
TOTAL DIRECT COST	761,510,000
Contingency	93,700,000
Project Administrative and Engineering Interest during Construction	76,150,000
TOTAL INDIRECT COST	169,850,000
<u>TOTAL ESTIMATED COST</u>	<u>\$931,360,000</u>

The US export potential for the Project is approximately U.S. \$300 million. This total includes all of the electromechanical equipment (estimated at approximately \$91 million of mechanical equipment, \$82 million of powerhouse electrical equipment, and \$40 million of transmission facilities), a portion of the conveyance facilities, and a portion of engineering and construction management services.

Costa Rica does not have any industrial facilities that produce electrical power generation equipment for large installations such as this Project. The physical characteristics of this Project are such that Francis-type turbines are likely to be used. There are at least two U.S. firms (American Hydro Corporation and Voith Hydro Inc.) that can be competitive for this equipment. The U.S. is also expected to be competitive in the areas of generator and transformer equipment, penstock steel, electrical and control systems, and engineering and construction services.

The potential equipment and services supplies for the Project and some of the potential U.S. suppliers are:

<u>Equipment / Service</u>	<u>U.S. Firms</u>
1. Hydroturbines	Voith Hydro American Hydro
2. Penstock Steel	Chicago Bridge & Iron McDermott Marine Corp.
3. Instruments & Controls	Foxboro Co. Bailey Controls (ABB) Emerson Process Management/Fisher- Rosemount
4. Electrical Systems and Substations	Westinghouse Electric General Electric Ideal Electric Co. Waukesha Electric Systems
5. Engineering Services & Construction Management	Montgomery Watson Harza Black & Veatch

SECTION F

FOREIGN COMPETITION AND MARKET ENTRY ISSUES

Most major foreign firms that compete in the global power generation market are currently represented in Costa Rica. European (Sulzer in Switzerland, Siemens-Voith in Germany, Alstom/ABB in France and Sweden), South American (Impsa in Argentina and Brazil), Japanese (Fuji, Mitsubishi) and Canadian (GE Canada/Kvaerner) firms are capable of supplying all major equipment and services for the Project³. Moreover, they can offer favorable credit support and other development incentives from their national governments.

³ Neither Siemens nor ABB makes hydroturbines. They make generators and heavy electrical equipment, which are designed and supplied in conjunction with hydroturbines made by Voith and Alstom respectively.

SECTION G

DEVELOPMENTAL IMPACT

This Project is expected to have a significant beneficial impact on the energy sector of Costa Rica and the Central American region. The infrastructure of the Costa Rican grid will be substantially augmented and strengthened by the investment in this Project, and Costa Rica will significantly enhance its ability to produce electricity inexpensively, reliably and with minimal environmental impact. As noted in Section B, the Project offers advantages that enhance its developmental impact: it is situated in one of the country's least developed areas and therefore offers both a cost-effective natural resource and the potential to catalyze socioeconomic growth in the southern part of the country.

Development of the Project would be consistent with the SIEPAC Central American Energy Integration and Development Plan, which is designed to reduce the burden on regional consumers of high oil prices, and to make the regional energy sector more sustainable, efficient and competitive. The plan includes actions in the short term aimed at cutting losses and reducing energy consumption; in the medium-term design to increase energy supply via renewable sources, including hydroelectric plants; and in the long term to promote changes in energy supplies such as wind and solar power projects, geothermal energy projects, bioenergy projects, large-scale hydroelectric projects, natural gas projects, etc.

In addition, the Project will support the goal of implementing market-oriented reforms regionally: increasing power supplies will enhance the potential for price efficiencies in the energy market, thus reducing costs generation and prices for the consumer and increasing price transparency. Energy produced by the Project will be deliverable to the SIEPAC grid. That should improve the regional market for power, because the Project will facilitate regional electricity trade and competitiveness. The Indicative Regional Generation Expansion Plan 2005 – 2019 prepared by the Central American Electrification Council's Regional Indicative Planning Working Group identifies capital and operations-related savings to the regional electric market of US \$157 million to US\$170 million, with a drop in long-term marginal costs of between US\$1.8/megawatt hour to US\$3.5/megawatt hour as a result of the development of large-scale hydroelectric projects.

This Project is also compatible with USTDA goals and is supported by the US Embassy in San José. Development of alternative energy sources is a priority for Central America, as well as one of the sectors specified in USTDA's CAFTA-DR Trade Integration Initiative. Furthermore, this Project is consistent with USTDA's commitment to the goals of the Mesoamerican Energy Integration Program (PIEM) in the context of Plan Puebla Panama; and with US Government interagency efforts to promote energy security in Central America through investments in alternative and renewable energy sources. It also supports the commitment to enhance investments in alternative and renewable energy sources, and the Commitment of the IDB and USTDA to work together to promote economic sustainability in the region.

SECTION H

IMPACT ON THE ENVIRONMENT

The Project will create a reservoir that will result in flooding of an area of approximately 5,500 hectares. The development of the Project would require resettlement of the population living in the affected areas, and the reach of the river immediately downstream of the dam will be bypassed by all but minimum environmental flows.

ICE has redesigned the Project from its original configuration to reduce potential environmental and social impacts. The area flooded by the reservoir was reduced from 10,700 hectares in the original plan to 5,500; the flooding of indigenous territory was reduced from 3559 hectares to 726 hectares; the indigenous population for which relocation was required was reduced from 839 to 0, and non-indigenous relocation was reduced from 1104 to 1068. IDB and CABEL will, moreover, fund economic and social impact studies⁴ that will include an analysis of the Project's impact on the population, including indigenous peoples, and the Project will be required to meet the IDB's policy guidelines with regard to resettlement and social issues. The Consultant has reviewed the anticipated social impact of the project as part of their funding recommendation to USTDA.

Hydroelectric projects offer society a number of environmental benefits when compared to fossil fuel plants. The principal benefit is that the use of hydroelectric resources will displace fossil fuels, thereby reducing pollution and global warming. However, the benefits also have some associated costs. There are three principal drawbacks of hydro. The first is disruption of ecosystems and human social systems which are located on land inundated by water impoundments (although periodic inundation of downstream areas due to uncontrolled floods is also reduced, thus reducing social system disruptions in the reaches below the impoundment). This is likely to be the most serious environmental concern associated with this Project, because of the extent of the inundation. The second is the impact on biota downriver from alterations in the quantity and quality of natural flow. This impact is particularly pronounced in the reach of the river which is bypassed by the Project's conveyance structures. In addition to the concerns associated with the bypass reach, concerns about environmental impact downstream of the main discharge structure must be addressed. The temperature, dissolved oxygen, pH, and other physico-chemical characteristics downstream of the plant discharge are also necessarily altered by the existence of the dam. A third drawback is the barrier that dams can pose to migrating fish species, although that has not been identified as a concern for this project. There is also a fourth, less widely adopted concern, that the aesthetic benefits of free-flowing rivers outweigh whatever social and aesthetic benefits might be associated with impoundments.

The Project has a significant impoundment, so the planned detailed environmental and social impact study will obviously be necessary to draw a final conclusion on the Project's net environmental impact. While there are certainly some environmental detriments associated with the Project, there are also environmental benefits that should be taken into account. At this stage it is reasonable to expect that the development of the Project would have a net beneficial effect on overall environmental quality for Costa Rica by the use of renewable resources for electric energy generation, and fostering economic growth generally. Adverse impacts will presumably be minimized as a result of conditions imposed on the Project by the IDB or other international development institutions involved in financing the Project, and by jurisdictional agencies in Costa Rica.

⁴ The studies and tasks to be performed will include a Comprehensive Environmental Impact Assessment, Socioenvironmental Studies, an Environmental Impact Assessment of the transmission civil works associated with the Project, establishing a panel of environmental experts, and establishing an interagency coordinating body.

SECTION I

IMPACT ON U.S. LABOR

Consultant has concluded that the impact on U.S. labor from the Project would be positive. The output of the Project would be exclusively electricity, which can be neither stored nor transported outside of the Central American integrated grid. The Project will provide badly needed electrical energy to support economic growth in Costa Rica, but the primary prospective impact of the Project on the US would be the enhancement of production levels by U.S. firms and importation into Costa Rica of capital goods.

Consultant has reviewed the scope of activities proposed for the Project and believes that it does not violate any of the legislative prohibitions on the use of Foreign Assistance Funds as specified in Public Law No. 103-306, 108 Stat. 1608 regarding U.S. Labor, export markets and other issues as applicable to the Project.

SECTION J

QUALIFICATIONS

I. The qualifications of the Contractors proposing to perform the geotechnical studies shall be evaluated as follows:

During the selection phase, the Contractor shall:

- Demonstrate thorough theoretical knowledge of geotechnical matters, in particular hydraulic fracturing techniques. (25 points)
- Demonstrate thorough theoretical knowledge of geotechnical matters, in particular seismic reflection methods. (25 points)
- Submit the name and CV of the engineer proposed to be in responsible charge of the testing, and one or more alternates, to ICE for approval. (15 points)

Any substitution after contract award will be subject to ICE approval.

- Demonstrate experience in fieldwork for drilling, hydraulic fracturing and HTPF. Contractor will submit a list and brief description of its experience in projects involving such techniques. (15 points)
- Demonstrate experience in fieldwork for seismic reflection applications. Contractor will submit a list and brief description of its experience in projects involving such techniques. (15 points)
- Supply a brief description of the software used for the processing and interpretation of test results. (5 points)

II. The qualifications of the Contractors proposing to perform the financial structuring studies shall be evaluated as follows:

The qualifications of the personnel proposed by Contractor will be weighted to take into consideration: a) academic background and qualifications; b) experience in similar projects as client or Contractor; and c) experience in financial structuring of similar projects. Complete facility with both conversational and written Spanish is required of all personnel unless express written waiver for specific individuals is applied for by Contractor and granted by ICE. The Contractor will supply a list of individuals proposed for the work, each subject to approval by ICE, with evidence satisfactory to ICE, that they meet the following desired characteristics:

Academic Background and Qualifications

- Team-oriented, results-based.
- Academically Qualified.

- Facility in the Spanish Language
- Excellent communication skills and ability to delegate.
- Demonstrated understanding of the technical aspects of hydroelectric project design, engineering and construction and to integrate them with advice and recommendations related to financing structures for the Project.
- Organizational skills.

(20 points)

Experience

The Contractor must provide, for each individual proposed, evidence satisfactory to ICE (preferably letters of recommendation signed by current or former clients), demonstrating the qualifications of such individuals in the following areas:

- Advisory services in the fields of engineering, economics, administration, or finance in the electric power industry or other regulated industries.

(40 points)

- Experience in the structuring of financing for infrastructure projects, preferably in Latin America, in areas such as:
 - Coordination with major international financial institutions.
 - Structuring of financing for electric generation projects, preferably hydroelectric, including limited-recourse financing.
 - Team leadership and reconciliation of both technical and financial considerations in decision-making.
 - Familiarity with fixed-income and equity markets on an international level, familiarity with the 144A market, and familiarity with sovereign debt analysis.
 - Familiarity with financial risk management instruments.
 - Studies and development of financing schemes for infrastructure projects.
 - The publication of articles on the subject of financial engineering may also be submitted as evidence of expertise.

(40 points)

SECTION K

RECOMMENDATION AND JUSTIFICATION

We believe that the Project has significant potential and merits further study. The studies proposed by the sponsor for USTDA support are well-conceived and appropriate to the stage of the Project. It is clear from the previously completed feasibility work that the ICE Project team is experienced and competent in managing studies such as this.

For those reasons, and the reasons described in detail in Section B-3 above, we have confirmed that the Project meets the USTDA funding requirements. We therefore recommend that USTDA support the \$500,000 estimated cost of the Geotechnical and Financial Structuring Studies for the Project.

SECTION L

TERMS OF REFERENCE AND BUDGET

The detailed information for the proposed FS for the Project is contained in the following attachments.

Appendix A	FS Terms of Reference
Appendix B	FS Budget
Appendix C	FS Schedule

APPENDIX A

TERMS OF REFERENCE

The Terms of Reference is provided for both Geotechnical Studies and Financial Structuring Studies as follows.

Appendix A-1	Geotechnical Studies
Appendix A-2	Financial Structuring Studies

APPENDIX A - 1

GEOTECHNICAL STUDIES

TERMS OF REFERENCE

TERMS OF REFERENCE

Contract for
**Geotechnical Studies for the El Diquís
Hydroelectric Project**

-
- TERM: 12 months
 - CONTRACT AMOUNT: USD \$300,000
-

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1. Summary

ICE-USTDA-02-GEOT: Geotechnical Studies for the El Dumas Hydroelectric Project				
Budget	BID	USTDA	ICE	TOTAL
	-	USD\$300,000		USD\$300,000
General Purpose	Perform <i>in situ</i> geotechnical studies at the Project site, and analyses at ICE offices, in order to refine the current geological and geotechnical models for both the conveyance tunnel and the powerhouse, in order to determine the magnitude and direction of stress in the underlying rock formation through hydraulic fracturing tests. In addition, perform 2D (two dimensional) seismic reflection studies along a Northeast/Southwest orientation for two sectors of the tunnel axis, including modeling and interpretation to support design and construction planning of the conveyance túnel, including characterization of the underlying formation and identification of fault zones, discontinuities, etc. likely to be encountered during construction.			
Specific Objectives	<p>Drill boreholes through the basement rock at the level of the subterranean powerhouse.</p> <p>Perform <i>in situ</i> measurements of the magnitude and direction of stress of the rock formation at the level of the subterranean powerhouse.</p> <p>Perform seismic reflection studies through the depth of the conveyance tunnel.</p> <p>Characterize the foundation rock formation through which the conveyance tunnel will pass, using the results of the seismic reflection tests.</p> <p>Model the seismic velocities of the formations at the depths indicated.</p>			
Scope	<p>The Contractor will plan, perform and interpret hydraulic fracturing tests (in accordance with ASTM Standard Test Method D4645 "Determination of the In Situ Stress in Rock Using the Hydraulic Fracturing Method") in two deep boreholes. Provision of the services must include the equipment necessary to drill the boreholes and carry out the tests, as well as the equipment and software to obtain and interpret the data.</p> <p>Drilling of two deep (500 m) boreholes will be necessary, and four hydraulic fracturing tests will be performed in each of the two boreholes.</p> <p>In addition, the Contractor will perform seismic reflection studies along the horizontal axis of the conveyance tunnel, including planning, performing and interpreting the data obtained during the geophysical testing.</p>			
Activities	<p>Drill two boreholes</p> <p>Perform hydraulic fracturing tests.</p> <p>Prepare and edit preliminary, draft final, and final reports.</p> <p>Plan, perform and interpret seismic reflection tests along a 5,600 m axis.</p>			
Work Product	<ul style="list-style-type: none"> • Preliminary Report • Draft Final Report on Hydraulic Fracturing • Draft Final Report on Seismic Reflection • Draft Final Report on Development Impact Analysis • Project Final Report 			
Term	12 months			
Observations on the Scope	The scope includes training for ICE personnel, as detailed below.			
Observations on the Term	The relatively long duration is intended to accommodate the drilling and testing of two deep boreholes (2 x 500m)			
Technical Comments	<p>The Contractor shall arrange for access of equipment and personnel to the drilling sites, as well as obtaining environmental permits and landowner authorizations.</p> <p>If so requested, ICE can provide certain equipment associated with the geophysical studies.</p> <p>Notwithstanding the foregoing, the Contractor must provide the necessary software and coordinate all logistics related to the use of such equipment.</p>			

2. Background

In February of 2004 the Instituto Costarricense de Electricidad (ICE) awarded contract CSL-01-03 "*Contratación de servicios de consultoría para el estudio de factibilidad del Proyecto Hidroeléctrico Boruca*" to the Colombian consulting firm INGETEC S.A. INGENIEROS CONSULTORES, with the purpose of evaluating several alternative Project configurations, selecting a preferred construction alternative, and completing the associated feasibility study.

Among the principal objectives of the study was selection of a preferred construction alternative in the first phase, so that a general evaluation of the general feasibility of the preferred construction alternative could be performed during the second phase of the contract. The first phase of the Project, including the evaluation and comparison of alternative Project configurations, concluded in February of 2005. The Project Management Committee adopted the recommendation of the Consultants and selected the Veraguas option at a reservoir level of 300 m.s.n.m. (the "Veraguas 300" option – hereinafter referred to as "El Diquís") as the preferred scheme, leading to a more detailed evaluation of that scheme during the second phase.

In November of 2005 the Consultants delivered to ICE the report "*Estudio de Factibilidad del Proyecto Hidroeléctrico de Boruca*" which integrated the results of the studies based on all available information, and which set forth a process for performing further studies, including those relating to social issues. The studies clearly established the likely economic viability, after taking into account environmental and social considerations (including sociopolitical issues), of the Veraguas 300 option.

One finding of the report was that certain additional investigations would be necessary to confirm and supplement the available data. The geotechnical studies described herein are an important element of the additional investigations.

3. Objective of the Study and Description of Tasks

Objective: the purpose of the geotechnical feasibility study (GFS) is to perform geotechnical investigations at specific portions of the El Diquis Project in order to refine the existing geological and geotechnical model along the tunnel axis and in the powerhouse area. This GFS requires (1) performing hydraulic fracturing tests in the powerhouse area to measure the magnitude and direction of stress in the foundation rock formation, and (2) performing two-dimensional seismic reflection tests along the tunnel axis, (3) processing and interpreting the data, and (4) incorporating the results into the model.

Task 1: Preliminary Matters, Preliminary Report and Kick-off Meeting

- 1.1 ICE and the Contractor shall each appoint a Designated Representative who shall be the formal and official point of contact between the parties.
- 1.2 The Contractor will deliver a preliminary report to ICE prior to beginning any site work. The preliminary report shall include the plan of work addressing the technical aspects of the hydrofracturing and seismic studies, and shall also include administrative matters related to quality assurance and quality control during performance of the contract. The Contractor shall deliver to ICE five print copies and an electronic version including all files in editable format. ICE may request the Contractor to provide additional reports addressing the services provided in the performance of the contract.
- 1.3 The Contractor shall convene a "kick off" meeting with the ICE Project staff to determine a timeline for project completion and determine the elements of the GFS that ICE staff will partake in.

Task 2: Drilling and Hydraulic Fracturing Tests

This Task is designed to measure the current state of stress, both magnitude and direction, present in the foundation rock, so that information can be utilized in the design of the powerhouse, intake and conveyance tunnel. It shall include recommendations for proper orientation of the powerhouse and the structural support required for the powerhouse, intake and conveyance tunnel, along with information relevant to the construction process. This Task shall be performed at the location of the powerhouse and intake of the El Diquís Project, near Palmar Norte, Costa Rica. The Contractor will, after consultation with ICE, decide which access route it will use to reach the drilling site. Alternative access routes are shown on the attached maps. The following are the sites under consideration:

Cuesta del burro

The entrance to this route is located approximately 10 km to the west of Palmar Norte, along the Costanera Sur Highway. It is approximately 22.5 kilometers long, gravel-surfaced with an average depth of 4 m and passable year-round. The last 2 km of this route, which ends at borehole PHB-RG-11-CM, becomes a trail with very irregular topography and is not suitable for motor vehicles.

Finca Camaronal

The entrance to this route is located approximately 4 km from Palmar Norte, along the Costanera Sur Highway. The first section of this route, with a length of 500 m, is gravel-surfaced and passable year-round; thereafter there is a section with a length of 2.9 km that is passable only in the summer dry season. The final section is a trail of 1.5 km, leading to borehole PHB-RG-12-CM, that is not suitable for motor vehicles.

Barrio Alemania

This route begins to the north of Barrio Alemania of Palmar Norte, with two sections. The first is a 700 m long gravel-surfaced road with 4 m depth, passable year-round, which extends from

Barrio Alemania to the storage tanks for the Palmar Norte aqueduct. The second section is a 1.8 km long trail that is difficult to access at any time of the year.

All of the costs and risks associated with transportation of equipment and personnel in connection with this contract are the responsibility of the Contractor.

2.1 The Contractor shall drill two boreholes of 500 m depth, in which the hydraulic tests will be performed. The boreholes will both have a diameter of approximately 3 inches or 76 mm, and will be carried to a depth of at least 500 m. To prevent the loss of rock fragments in the shallow stages of drilling, the Contractor must use casing. The Contractor shall grout unstable sections. The Contractor shall provide its own equipment, labor and services necessary to drill the boreholes and perform the hydraulic fracturing tests, as well as the equipment and software to obtain and then interpret the resulting data.

2.2 The Contractor shall make available all drilling logs and core samples to ICE for its inspection and review.

2.3 The Contractor shall conduct tests and data processing for the hydraulic testing of pre-existing fractures ("HTPF") and shall process the data from local seismic detection networks installed by ICE, which will assist in the interpretation of the results. The Contractor shall perform four hydraulic fracturing tests in each of the two boreholes in accordance with ASTM Standard Test Method D4645 "Determination of the In Situ Stress in Rock Using the Hydraulic Fracturing Method"). The Contractor shall work in coordination with ICE to determine the exact location and depth at which the tests shall be performed taking into consideration (a) the drilling data from the borehole, (b) inspection of recovered core samples, and (c) confirmation that the testing fully characterizes the lithology in the areas in which the civil works will be performed.

2.4.1 Upon completion of the testing, the Contractor shall report on the magnitude and direction of the stress present in the foundation rock, to support the design of the powerhouse, intake and conveyance tunnel of the El Diquís Project site.

2.4.2 The Contractor shall perform all processing and interpretation of the data from the drilling and hydraulic fracturing tests at the El Diquís Project site and at the offices at ICE's Project and Support Services Building, Sabana Norte, San José. ICE personnel shall be entitled to monitor and review all data gathering and processing activities.

Task 3: Draft Report on Hydraulic Fracturing

The Contractor shall produce a Draft Report on Hydraulic Fracturing that will include the following headings:

- Drilling of Boreholes
 - Description of Equipment Used
 - Description of Drilling Logs and Results
 - Photographic Record of Core Recovery
- Hydraulic Fracturing Tests
 - Procedures and Performance of Fieldwork

- Data Obtained (including a listing and classification of the original data).
 - Analysis and Interpretation of Test Results
 - Discussion of the Results and Their Relevance to the Design and Location of the Project Works
- Conclusions and Recommendations

The Contractor shall submit to ICE 10 printed and bound copies and 10 copies in electronic format recorded on CD of a Draft Report on Hydraulic Fracturing in draft form for review and comment.

Task 4: Geophysical Investigations

The geophysical fieldwork of this Task will take place between Pejibaye de Pérez Zeledón and Palmar Norte. The Processing and interpretation of the seismic reflection data will take place at the central offices of ICE

- 3.1 The Contractor shall perform seismic studies to characterize the lithology along the longitudinal axis of the tunnel. ICE shall provide the equipment and the field personnel to perform this testing. The Contractor shall coordinate all logistics associated with the utilization of such resources.
- 3.2 The Contractor shall obtain seismic sections in two dimensions, oriented along the Northeast/Southwest axis of the tunnel, in the two sectors described in Section 3.3. The Contractor shall interpret and model the data to support the construction planning for the tunnel, including characterization of the rock types likely to be encountered during construction and indicating the zones of weakness (including but not limited to, faults, discontinuities, and intrusions).
- 3.3 The Contractor shall perform the planning, performance and data processing for the geophysical studies in two sectors along the axis of the conveyance tunnel: the first sector will encompass the stations 2+600 through 5+000; the second sector will encompass the stations 10+000 to 13+200. The two sectors combined comprise a total length of 5600 m. Seismic profiling should be taken to a depth of between 1000 and 1500 m.

Task 5: Draft Report on Geophysical Studies

5.1 The Contractor shall produce a Draft Report that will include, at a minimum, the following headings:

- Methodology for Processing Data from Geophysical Testing
- Profiles Resulting from Interpretation of Seismic Reflection Studies
- Conclusions and Recommendations
- Structural Characteristics of Particular Interest or Concern in the Segments Studied: Faults and Geological Discontinuities (Anomalies, Stratigraphy, Intrusions, etc.)
- Prediction of Zones Along the Tunnel Axis Most Likely to Cause Construction Difficulties.

- Physical Parameters, Such As Modulus of Elasticity and Other Characteristics, of the Foundation Rock
- Recommendations for Temporary Support and Shoring of the Tunnel during the Construction Process.
- Conclusions and Recommendations

5.2 The Contractor shall deliver to ICE 10 printed and bound copies and 10 copies in electronic form recorded on CD of a Draft Report on Geophysical Studies in draft form for review and comment.

Task 6: Training Seminars

The Contractor will provide training for ICE staff to familiarize them with the practices and procedures involved with both hydraulic fracturing studies and seismic studies.

6.1 The Contractor shall provide training for up to 30 ICE professionals (to be selected by ICE) at ICE headquarters, in Spanish, that will cover the performance of all phases of the hydraulic fracturing. The training shall include a two-day course that covers both performance of the tests and interpretation of the resulting data. In addition, the training shall include a one-hour seminar on case studies in which hydraulic fracturing has been used as a design tool for subterranean excavation. The Contractor shall supply a PowerPoint presentation on CD and a three-ring binder with color copies of all presentation slides for each of the 30 ICE participants.

6.2. The Contractor shall also provide training for up to 30 ICE professionals at ICE Headquarters, in Spanish, that will cover the performance of all phases of the seismic reflection studies. The training shall consist of a two-day course which covers both performance of the tests and interpretation of the resulting data. The training shall include all aspects of fieldwork, as well as processing and interpretation techniques. The Contractor shall supply a PowerPoint presentation on CD and a three-ring binder with color copies of all presentation slides for each participant.

Task 7: Final Report

Following presentation of the Draft Reports to ICE, the Contractor shall make itself available to draft and document modifications and clarifications which may be necessary pursuant to the request of ICE. The Contractor shall receive comments from ICE on the Draft Reports on Hydraulic Fracturing and Geophysical Studies, and after discussion with ICE the Contractor shall revise and incorporate the relevant comments into a Draft Final Report.

After submitting the Draft Final Report to ICE, the Contractor shall travel to ICE headquarters to make an oral presentation to ICE and shall make any changes to the reports required as a result of the discussions.

The Contractor shall then prepare and deliver to ICE and USTDA a substantive and comprehensive Final Report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all topics required to be included in the draft reports previously provided to ICE. The Final Report shall be prepared in accordance with Clause I of Annex II of the Grant Agreement between USTDA and ICE, attached as Appendix B. It shall be prepared in English and Spanish.

Contractor shall deliver one original and nine copies of the Final Report, all duly executed, with 10 copies in electronic form recorded on CD, to ICE and to USTDA as described in the next section. Copies in the English language shall be provided in accordance with Appendix B.

The Contractor and ICE shall ensure that the public version of the Final Report contains no secure or confidential information.

The Contractor is responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.

ICE and USTDA shall have an irrevocable, worldwide, royalty-free, non-exclusive right to use and distribute the Final Report and all work product that is developed under these Terms of Reference.

4. Requirements of the Reports

All Reports submitted to ICE shall comply with the following requirements:

- a) The metric system will be used for all calculations, quantity takeoffs, etc. The scaling used for the drawings will be consistent with the metric system and with accepted engineering practice.
- b) All text, figures, charts, graphs, drawings, etc. in Draft Reports will be in the Spanish language. The Final Report text, figures, charts, graphs, drawings, etc. will also be presented in the English language, in accordance with Appendix B.
- c) All reports will be prepared in accordance with the instructions established by ICE unless otherwise agreed by both parties
- d) The stipulated number of printed and electronic copies of all reports shall be delivered to ICE and USTDA, in the format of WORD for Windows (for text) and the figures, maps, charts, tables, graphs, etc. will be in PowerPoint, Excel, AutoCAD v. 13, Idrisi, ARCINFO, ARCVIEW, and Project Manager.
- e) For the Final Report, 10 copies in the English language printed and bound and ten electronic copies recorded on CD will be delivered to USTDA contemporaneously with delivery to ICE at the following address:

US Trade and Development Agency

c/o Ms Kate Maloney
1000 Wilson Boulevard
Suite 1600
Arlington, VA 22209-3901

- f) If Contractor wishes to supply information using other computer programs, it shall supply them along with licenses for use such that ICE and TDA can use, audit and verify the data and programs in the context of this specific Project without restriction.

5. Term

It is expected that the services performed under this contract can be completed within 12 months (360 calendar days), including the time required to draft reports and incorporate additions and clarifications which respond to ICE comments and suggestions. The anticipated maximum duration of the seismic reflection fieldwork is three months from the date of mobilization.

6. Selection and Qualifications of the Contractor

During the selection phase, the Contractor shall:

- Demonstrate thorough theoretical knowledge of geotechnical matters, in particular hydraulic fracturing techniques. (25 points)
- Demonstrate thorough theoretical knowledge of geotechnical matters, in particular seismic reflection methods. (25 points)
- Submit the name and CV of the engineer proposed to be in responsible charge of the testing, and one or more alternates, to ICE for approval. (15 points)

Any substitution after contract award will be subject to ICE approval.

- Demonstrate experience in fieldwork for drilling, hydraulic fracturing and HTPF. Contractor will submit a list and brief description of its experience in projects involving such techniques. (15 points)
- Demonstrate experience in fieldwork for seismic reflection applications. Contractor will submit a list and brief description of its experience in projects involving such techniques. (15 points)
- Supply a brief description of the software used for the processing and interpretation of test results. (5 points)

7. Obligations of the Contractor

The Contractor shall:

- Furnish all equipment necessary to perform the drilling and the hydraulic fracturing tests, including a method of recording the fracturing, such as photographic record or borehole packers
- Furnish all software (with valid license) necessary or appropriate for the processing and interpretation of the tests specified, and geophysical modeling of the specified tunnel sections.
- Comply with the provisions of Annex 1 to this document, entitled "PARÁMETROS A SEGUIR EN LA RELACIÓN CON LOS PROPIETARIOS".
Take direct charge of supervision of the work and planning the field testing in coordination with the ICE Designated Representative. The engineer in responsible charge shall be present onsite throughout the performance of the tests.
- Interface with ICE to assure technology transfer throughout the performance and interpretation of the tests.
- Review and analyze the most current information available about the Project as of the date of mobilization, and incorporate whatever information becomes available during the performance of the work.
- Take note of national legislation in effect as well as the directions and observations issued by ICE that may be relevant to the proper performance of the studies.
- Draft and document any modifications or clarifications which may be required regarding the completed study, in accordance with ICE's requests.
- Throughout the performance of the work, maintain an open and direct communication with ICE, through the ICE Designated Representative.
- Maintain complete confidentiality regarding pricing, files, logs, maps, reports and other documents related to the work. All the information produced in connection with this Project will be the exclusive property of ICE and may not be disclosed to third parties without express written authorization from ICE.
- Provision of services will be exclusively for the benefit of ICE, whose liability is strictly limited in accordance with the terms of this contract, and Contractor shall indemnify ICE against any responsibility or claim for labor or any other claim against it arising directly or indirectly from third parties, for any reason, including imprudence, negligence or carelessness of ICE personnel in the performance of the services.

- Furnish transportation and other logistical support, internal and external, required to mobilize for the work and all associated tasks.

8. Obligations of ICE

ICE will:

- Provide Contractor with all information at its disposal for the performance of the contracted services and will perform its obligations as set forth in this contract.
- Appoint a Technical Coordinator who will be in charge of the ICE technical team and who will be responsible for oversight of the quality of work and the referral to the ICE Designated Representative of technical concerns and technical information relevant to the execution of the work.
- Appoint an Administrative Coordinator (the person described in Task 1.1) who will serve as the ICE Designated Representative, who shall be responsible for oversight of the Contractor's work and who shall be the official and formal point of contact for the exchange of information with the Contractor's Designated Representative. Under no circumstances shall any contract modification or interpretation have any validity unless it is in writing and signed by the Designated Representatives of both parties.
- Work with the Contractor to support its technical and administrative management during performance of the work.
- Provide the Contractor with the physical space required to locate its equipment for processing data and for discussion of testing and test results.
- Make available to the Contractor following geophysical test equipment:
 - Seismograph, type Stratavisor NZ made by Geometrics. This model has 40 channels and a 24-bit analog/digital converter.
 - Seismic sensors, each with groups of nine geophones with 14 Hz bandwidth.
 - Multi-conductor cables
 - Roll switch.
 - Augers, shovels y pickaxes for excavations.
 - High velocity explosive compound and blasting caps.
 - Detonation wires and safety cords.
 - Walkie-talkies.
 - Continuity testers.
 - No.18 twin cables.

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APPENDIX A

Prior Geological Studies at the Site

Information available to ICE indicates that the location of the powerhouse where the hydraulic fracturing tests will take place is characterized by a series of sedimentary materials corresponding to limestones of the Fila de Cal formation and sandstone, shale and breccia of the Térraba formation. In places this formation also includes intrusive igneous rock, i.e., gabbro, corresponding to the Puerto Nuevo formation. A geological map of the area is attached.

Based on data from earthquake monitors, as well as kinematic sensors in mesoscopic faults at various representative depths, the maximum horizontal stress at both a regional and local scale is estimated to be, on average, oriented N33°E. In addition, the relative and absolute magnitude of the stress has been estimated at various depths. However, because of the relative tectonic complexity of the formation, there are probably major variations in the direction of the stress near the regional faults, and the Cordillera Costeña may also be causing deflections, so it is therefore necessary to perform the testing *in situ*.

Three boreholes have been drilled to date in this area, the first with a depth of 165 m (PH-RG-09-CM), the second with a depth of 501 m (PH-RG-11-CM), and a third with a depth of 490 m (PH-RG-10-CM).

Borehole PHB-RG-09-CM encountered materials of the Térraba formation, as shown in the attachment. Core recovery percentage and Rock Quality Determination (RQD) were both very low to depths of 55 m, with an RQD of 0%. From 55m to 100m the RQD improved, with only a few sections which were highly fractured and in which the RQD percentage was reduced. From 100 m to 165 m the quality of the material was considerably improved and the RQD was higher than 75% in virtually all of the core samples.

With respect to the phreatic level, through the shallow drilling process it maintained a relatively constant level at an average depth of 56 m, as shown in the attached figure.

As it was not possible to complete borehole PHB-RG-09-CM due to technical problems, a second borehole (PHB-RG-11-CM) was drilled at a nearby location. The second borehole reached a depth of 501 m and intersected layers of sandstone and shale in the Térraba formation and reached the intrusions of the Puerto Nuevo formation, as can be seen in the attachment. For this borehole a tricone rock bit was used for the shallow drilling and therefore no core was recovered above 89 m depth.

In general the materials in borehole PHB-RG-11-CM above 331 m were relatively sound with high recovery percentages, except for the zones where the degree of fracturing is higher, as can be seen by comparing the figures for RQD and the number of fractures shown below. Below 331 m a basic, intrusive body is encountered, with little fracturing and fairly high percentages of RQD.

The phreatic level above 331 m was fairly stable, varying between 40 m and 73 m in depth. On reaching the intrusive body some variability was observed, as shown in the graph illustrating the phreatic levels, with measurements between 150 m and 300 m. However, upon grouting the level tended to stabilize, leading to the conjecture that the intrusive body is impermeable and acts as a barrier, and that once the seal is broken during the drilling process the water tends to leak out. This possibility has not been verified, through the placing of pietzometers to continue monitoring the phreatic levels.

The foregoing information may be used by the Contractor, but the Contractor will assume full responsibility for whatever use or interpretation it makes of the data. Detailed results of the prior studies will be made available to prospective bidders by ICE, without warranty of any kind by ICE as to accuracy or completeness.

APPENDIX B

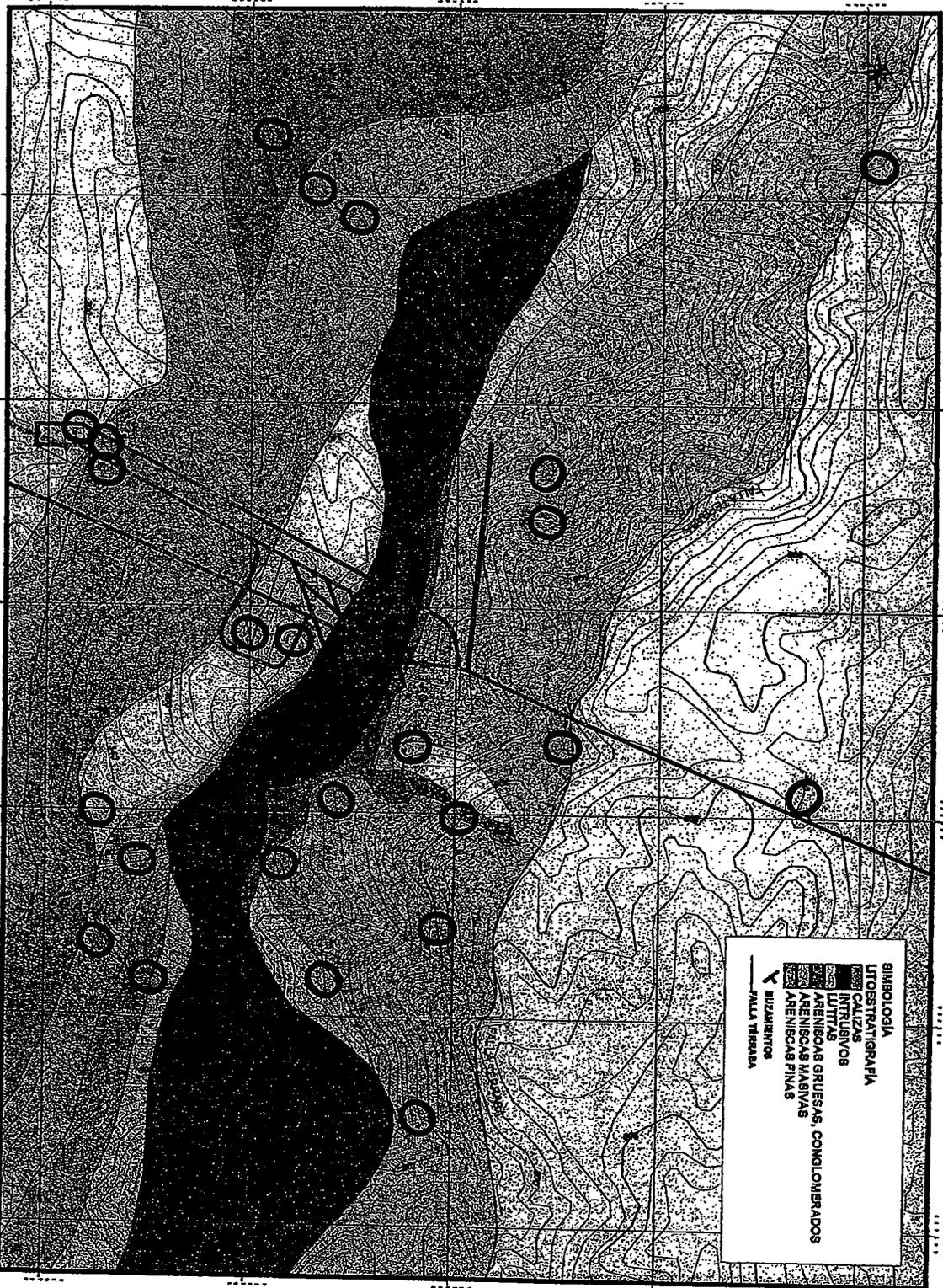
**Clause I of Annex II of the Grant Agreement between USTDA
and ICE**

[[[To Come]]]

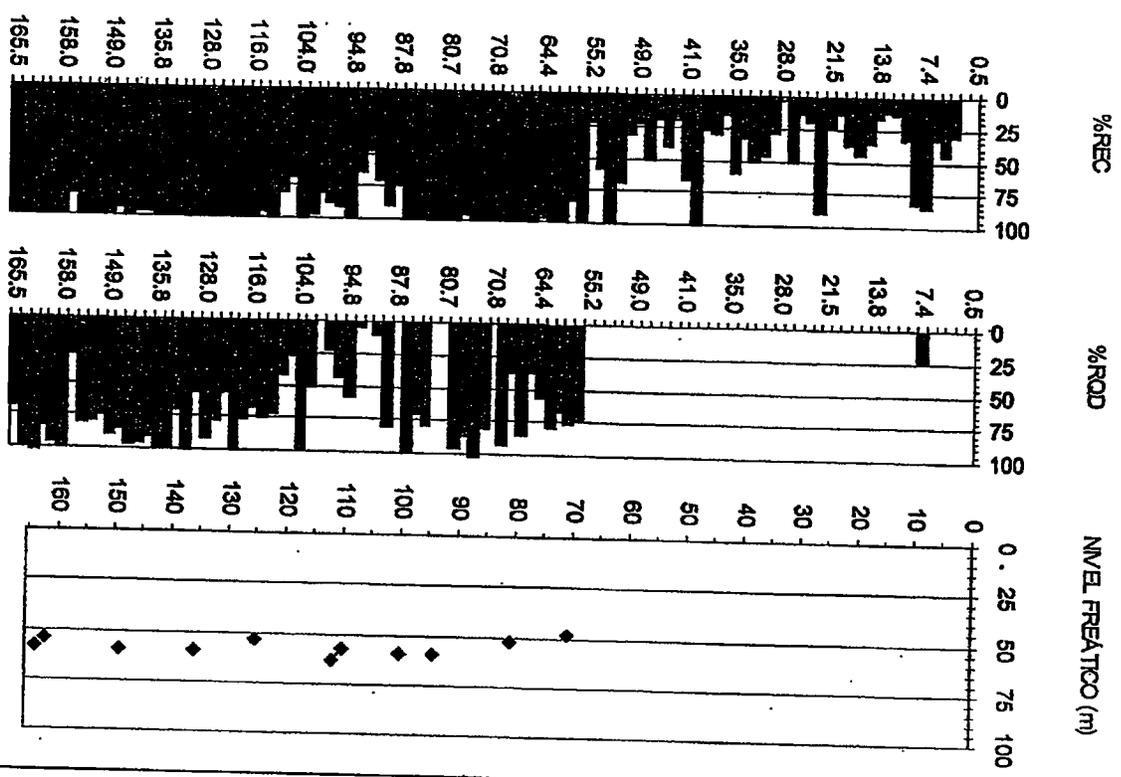
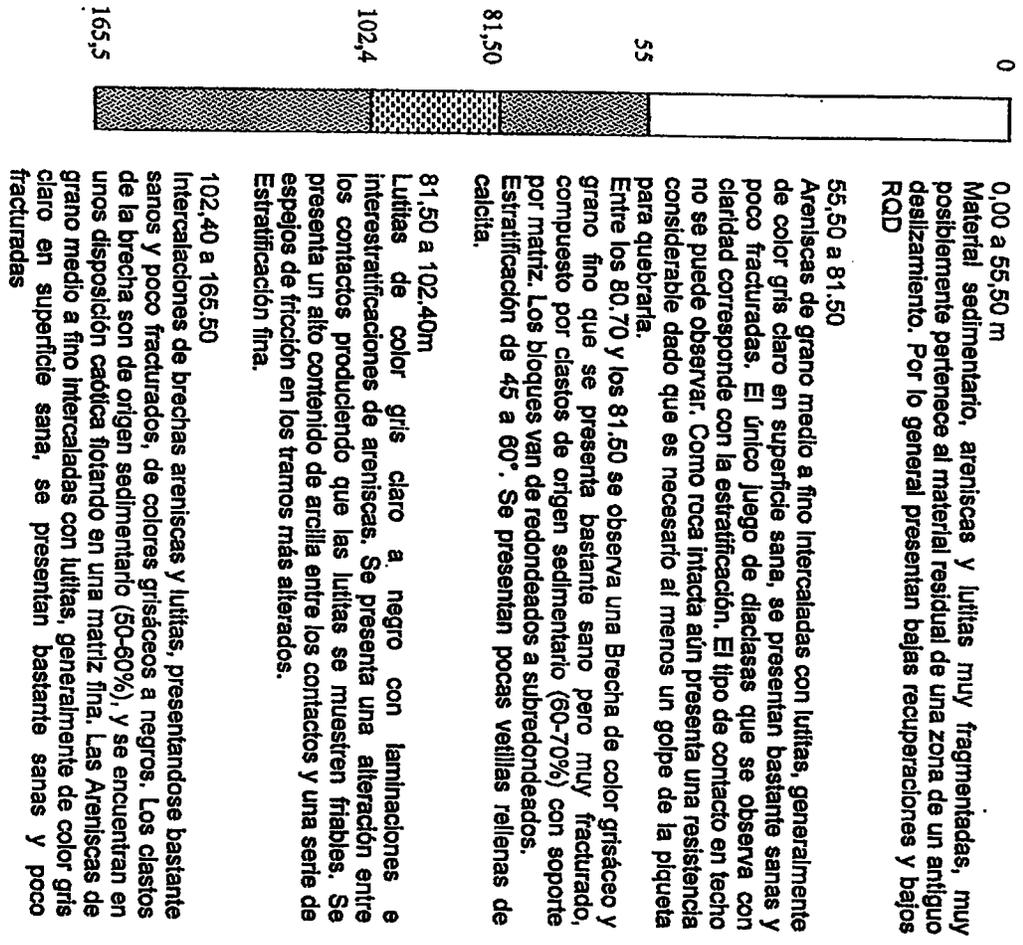
APPENDIX C

Relevant figures and data

MAPA GEOLÓGICO DEL SITIO



ESQUEMA PERFORACIÓN PHB-RG-09-CM



ESQUEMA PERFORACIÓN PHB-RG-11-CM

89,0

108,6

265,0

316,7

331,2

493,0

501,0

89,00 a 108,60
Lutitas de color gris claro a negro con laminaciones e interestratificación areniscas. Se presenta una alteración entre los contactos produciendo que lutitas se muestran friables. Se presenta un alto contenido de arcilla entre contactos y una serie de espejos de fricción en los tramos más alterados. Estratificación fina

108,60 a 265,00
Areniscas de grano medio a fino intercaladas con lutitas y brechas, general de color gris claro en superficie sana, se presentan bastante sanas y fracturadas. Las lutitas son se presentan de color gris claro hasta negro y general con estratificación fina. Los clastos de la brecha son de carboníferos (50-60%), y se encuentran en una disposición cádica flotante una matriz fina. Se presenta en colores grisáceos

El juego de diaclasas que se observa con mayor claridad corresponde a estratificación. El tipo de contacto en techo no se puede observar. Como intacta aún presenta una resistencia considerable dado que es necesario un golpe de la piqueta para quebrarla.

En general se presentan dos juegos de fracturas uno correspondiente a estratificación con planos ondulados, presentándose algunos espejos de fricción. El otro juego se presenta en vertical.

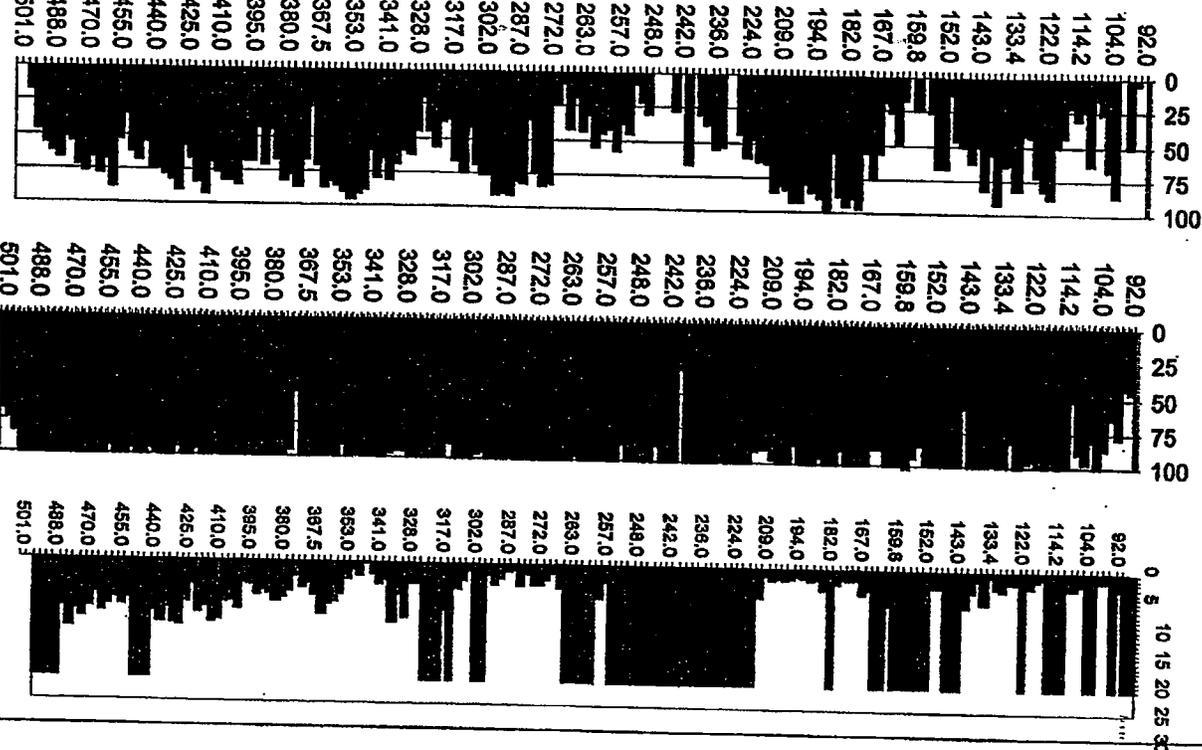
Estratificación de 45 a 60°. Las fracturas se presentan rellenas de calcita

265,00-316,70
Se presentan areniscas gruesas intercaladas con areniscas medias y presentando un bandeamiento que no se observaba en las areniscas de la superior. Es una roca de color gris claro hasta blanco muy sana y poco fracturada. presencia de pirita, muy probable que se encuentre cerca del contacto intrusivo.

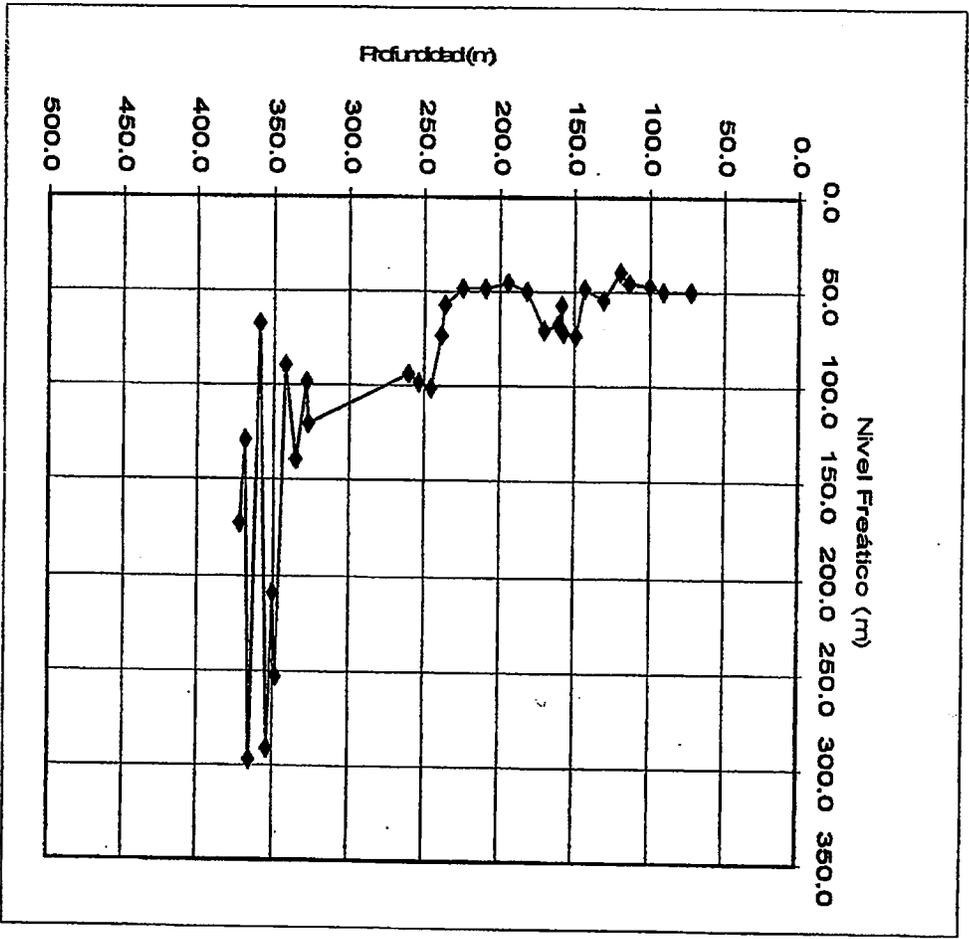
316,70-331,20
Rocas blancuzcas altamente pulverizables por el efecto de la alteración hidrotermal de los materiales.

331,20-493,00
Intrusivo de composición básica probablemente un gabro bastante sano y fracturado, con fuertes contenidos de pirita. Hacia la base se comienza a tener un más fino probablemente por un enfriamiento más rápido.

493,00-501,00
Rocas blancuzcas altamente pulverizable por el efecto de la alteración hidrotermal de los materiales, similar al contacto superior de los intrusivos.



PERFORACIÓN PHB-RG-11-CM



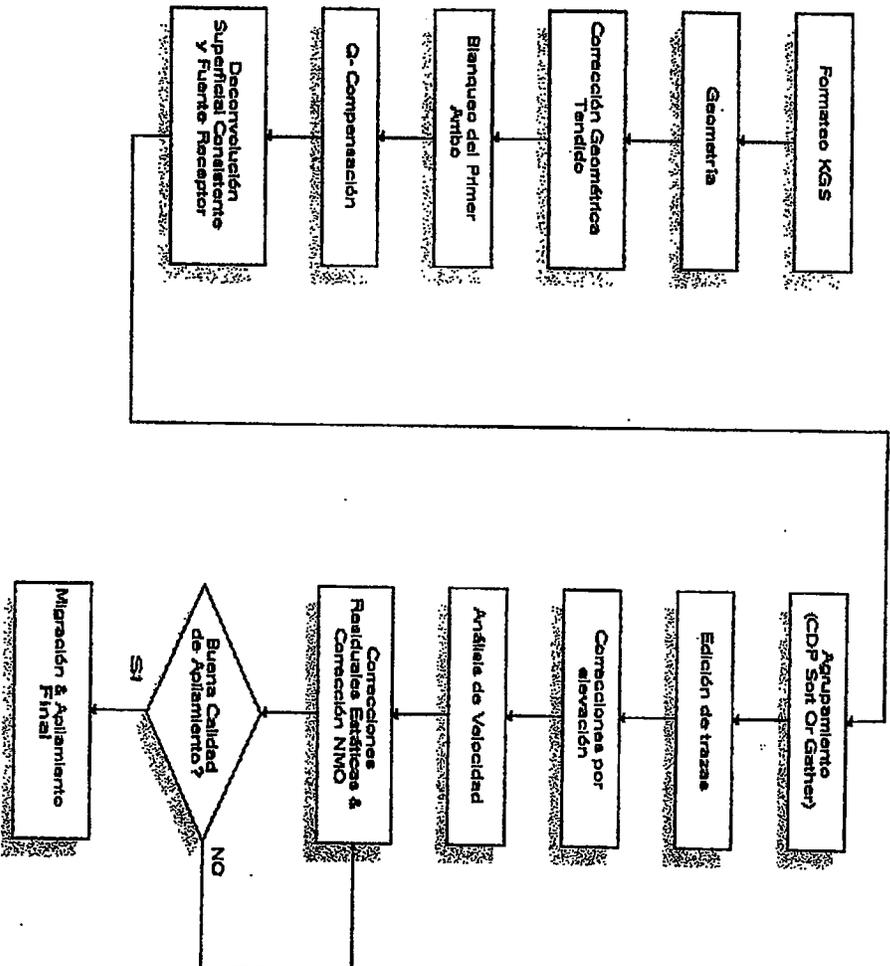
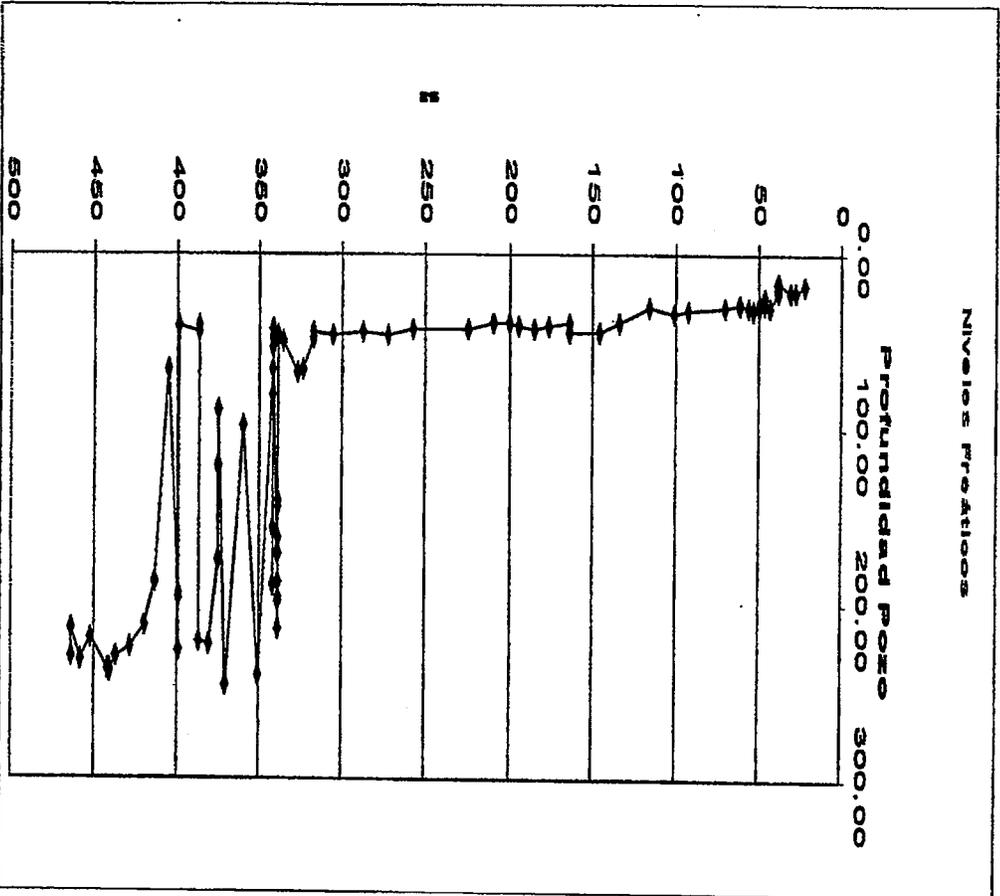
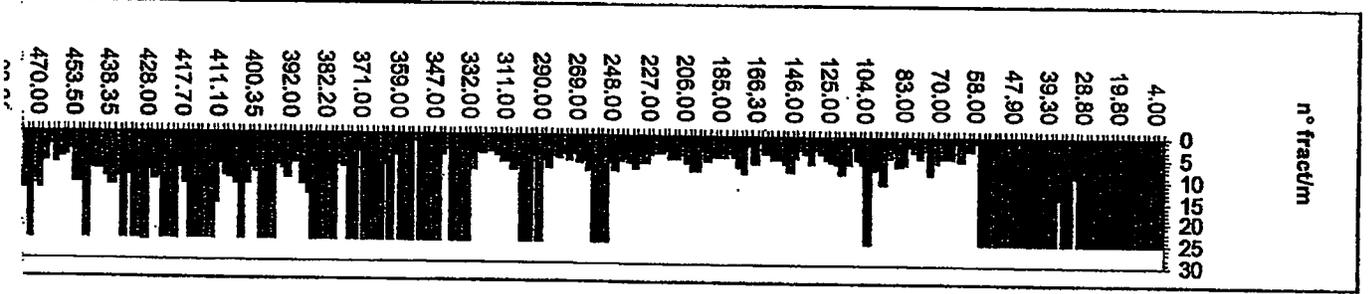
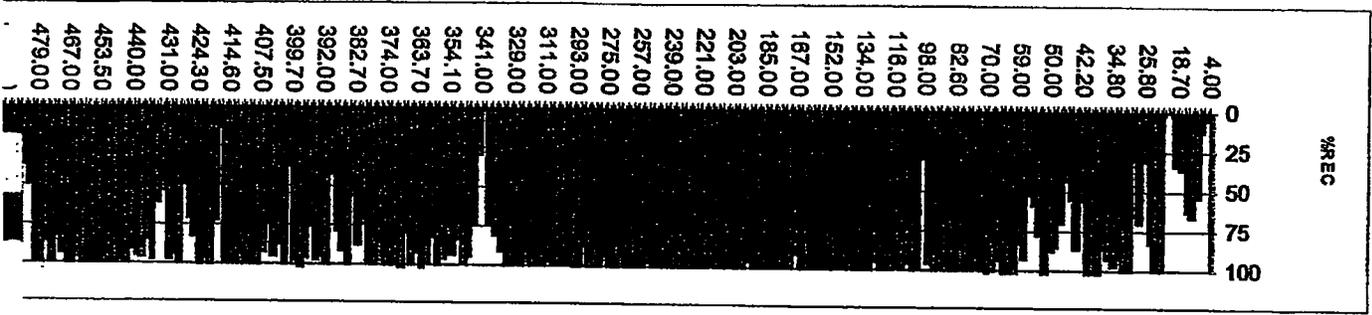
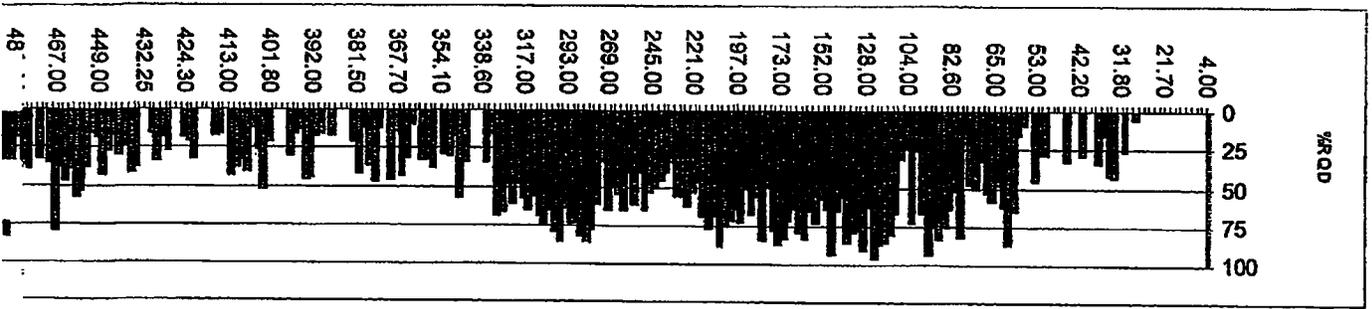


Diagrama de procesamiento de la Información Geofísica

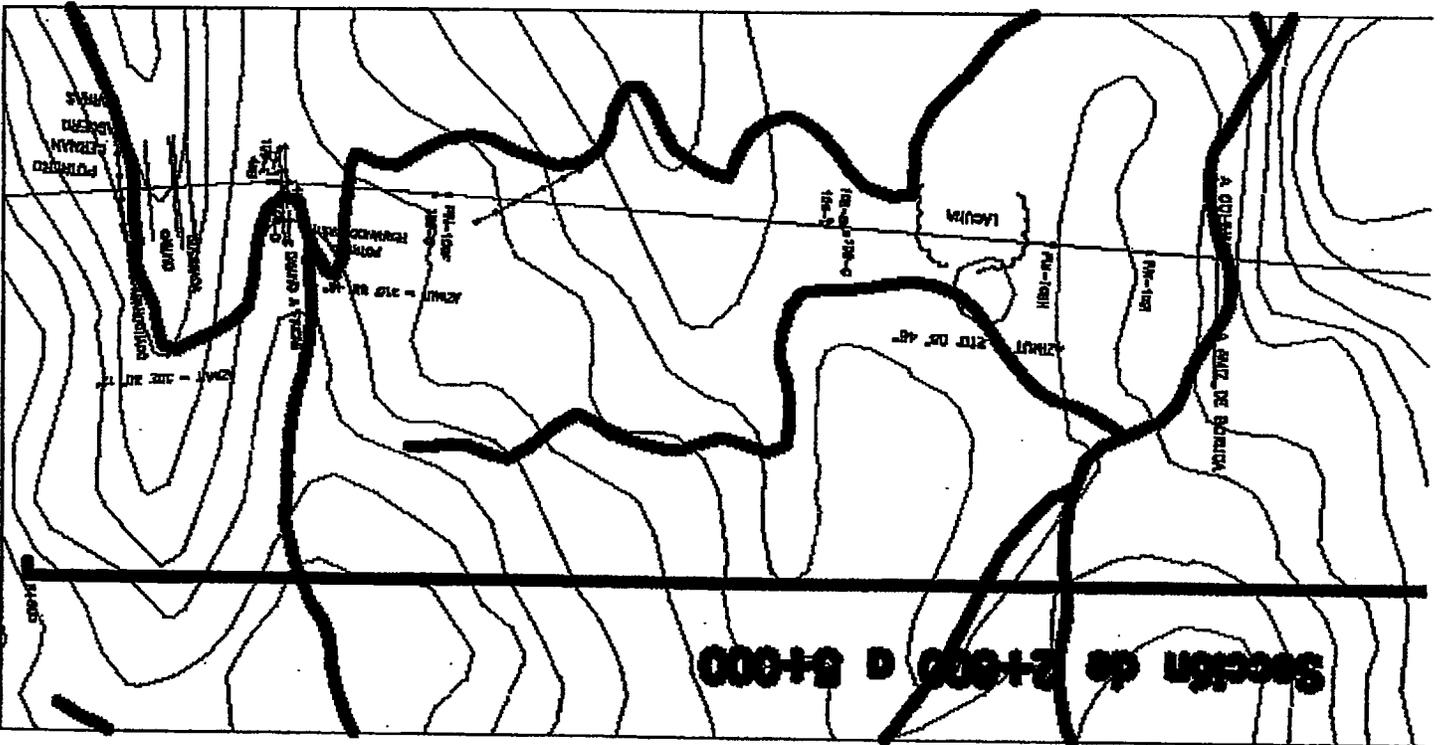
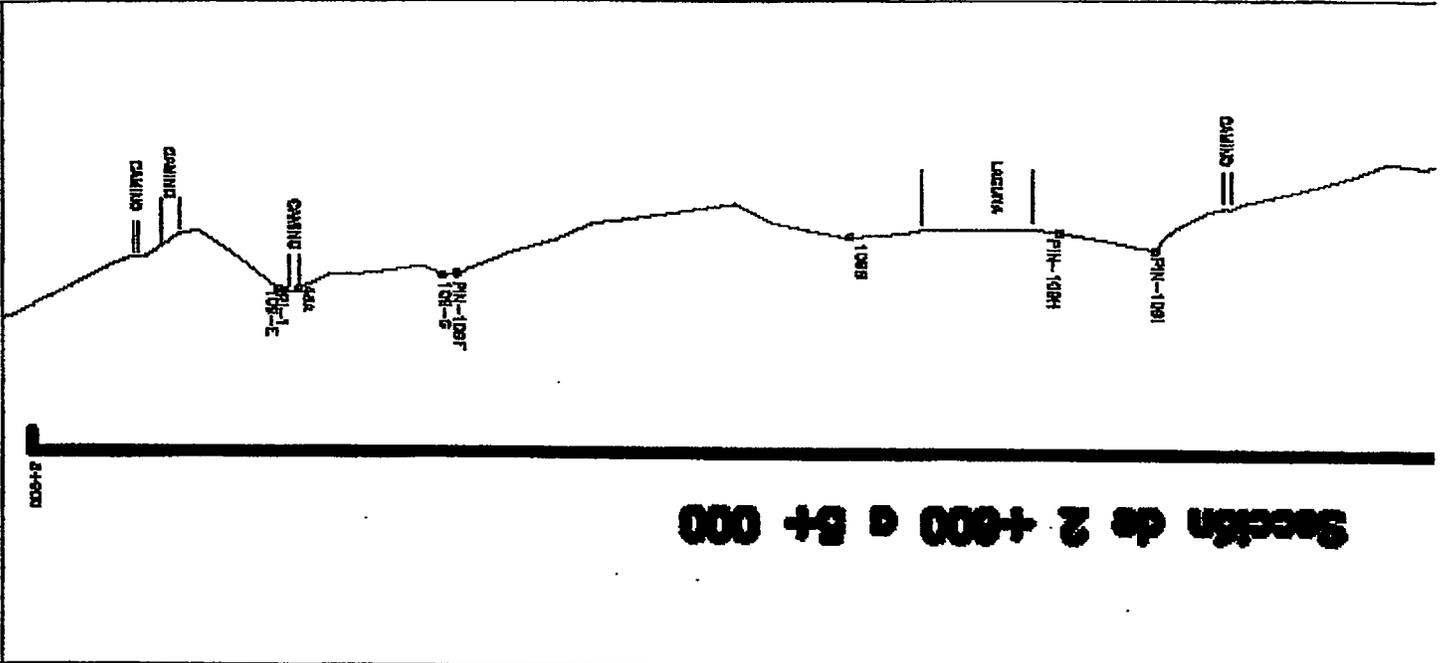
PERFORACIÓN PHB-RG-10-CM

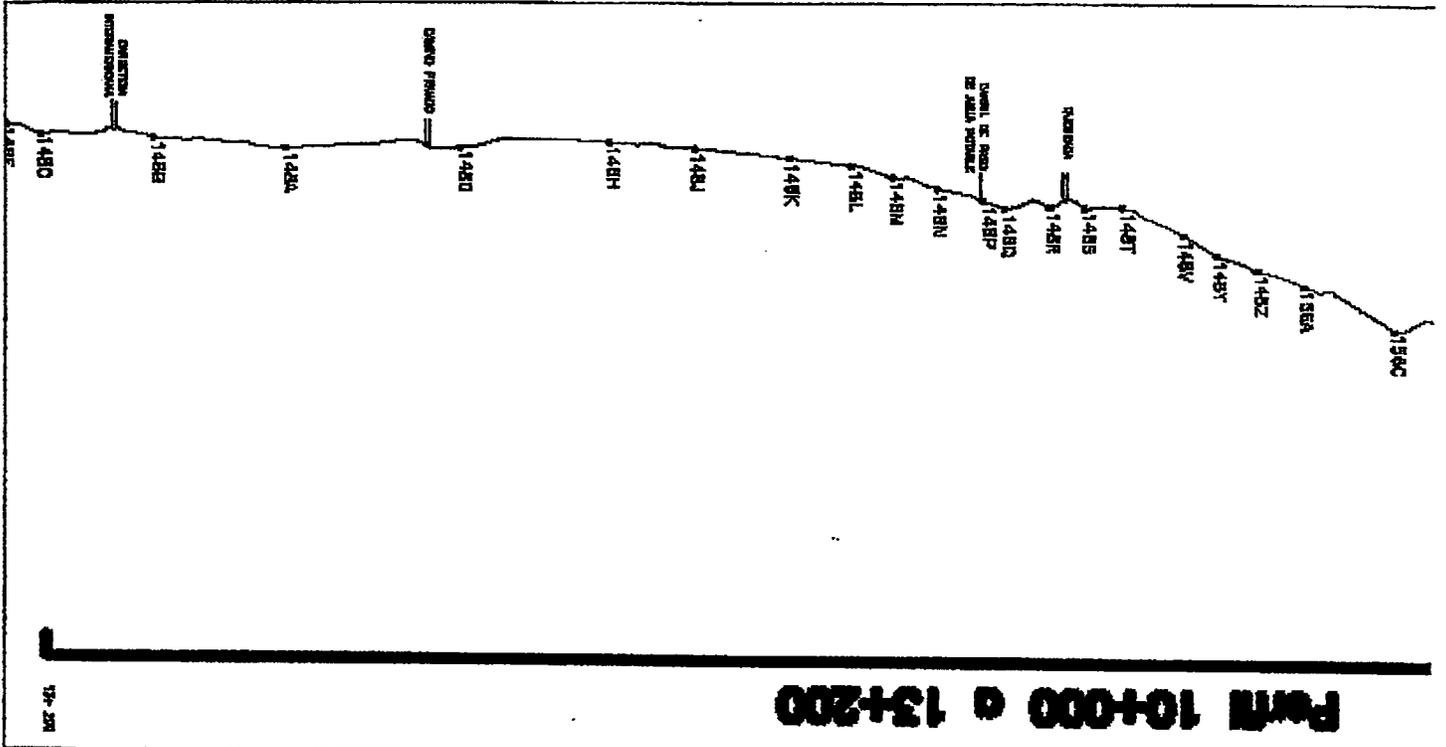


ESQUEMA PERFORACIÓN PHB-RG-10-CM

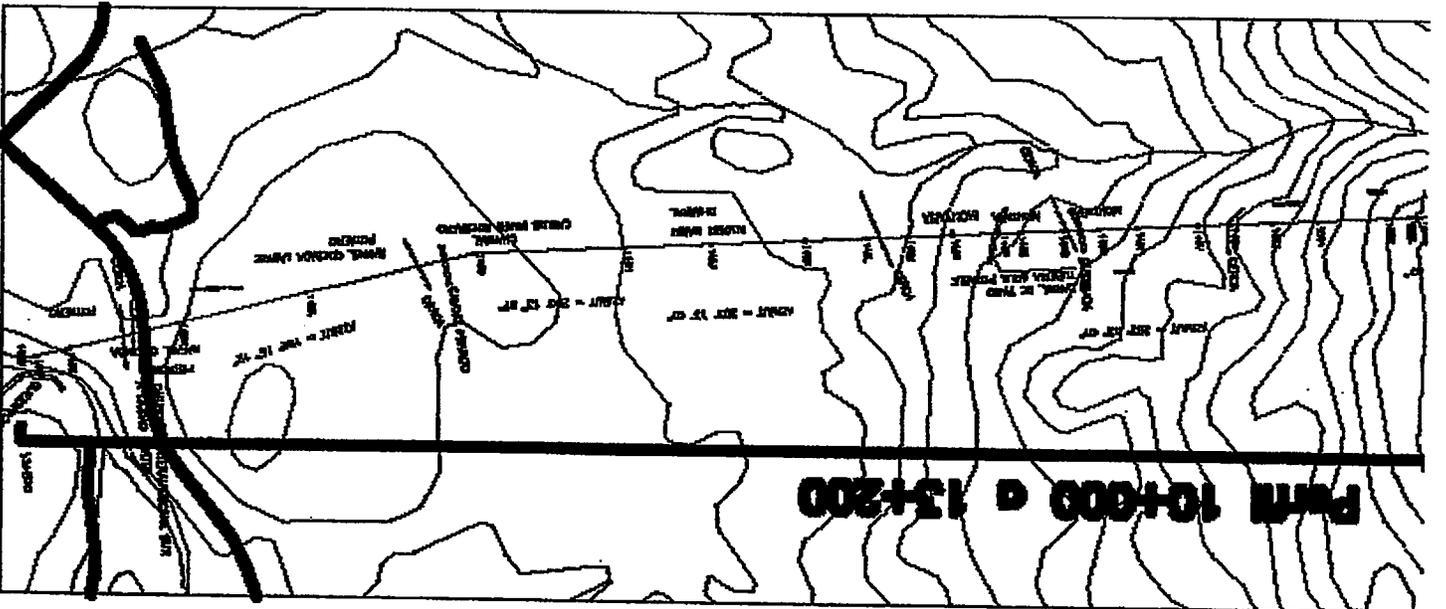


137-00-140,00m	Arquitas blancizas muy pulverizables de grano medio, presentan laminación paralela y alcos contenidos de poca.
140,00-346,50m	Intuitivo de composición blanda bastante fino, al cual se presenta bastante fraccionado muchos de los mancos. Los últimos mancos del intuitivo se vuelve un poco más fino.
346,50-349,10m	Arquitas blancizas blanda hidrotérmicamente, se presenta muy pulverizables y por lo que se ha visto en la perforación superior, está asociado con el contacto inferior del intuitivo.
349,10-358,00m	Arquitas de grano fino a medio, muy afectadas por el efecto del intuitivo, presenta laminación paralela y alcos contenidos de poca, se presenta muy fraccionada.
358,00-388,20m	Intercalaciones de arenitas gruesas que van desde arenitas finas a medias con conglomerados finos, los alcos del conglomerado son de origen sedimentario y presentan cemento Dorsale. Las arenitas presentan laminación paralela y se presentan bastante arenosa.
388,20-396,50m	arenitas finas color gris claro a blanquecino. Se presentan arena pero bastante fraccionada.
396,50-461,00m	Intercalaciones de lutitas y arenitas de color grisáceo, con alto grado de fraccionamiento y con laminación paralela.
461,00-469m	Perilla brecha calcárea, color blanquecino muy fraccionada
469-475,50m	Intercalaciones de arenitas y lutitas, color gris oscuro, presentan laminación paralela y están muy fraccionada
475,50-490,50	Calizas roscadas algáceas. Se puede observar pequeñas intercalaciones de arenitas de un máximo de 20 cm, es posible que en algunos tramos se presenta un brecha calcárea





Part 10+00 to 13+200



Part 10+00 to 13+200

ANNEX 3



**U.S. TRADE AND DEVELOPMENT AGENCY
Arlington, VA 22209-2131**

NATIONALITY, SOURCE, AND ORIGIN REQUIREMENTS

The purpose of USTDA's nationality, source, and origin requirements is to assure the maximum practicable participation of American contractors, technology, equipment and materials in the prefeasibility, feasibility, and implementation stages of a project.

USTDA STANDARD RULE (GRANT AGREEMENT STANDARD LANGUAGE):

Except as USTDA may otherwise agree, each of the following provisions shall apply to the delivery of goods and services funded by USTDA under this Grant Agreement: (a) for professional services, the Contractor must be either a U.S. firm or U.S. individual; (b) the Contractor may use U.S. subcontractors without limitation, but the use of subcontractors from host country may not exceed twenty percent (20%) of the USTDA Grant amount and may only be used for specific services from the Terms of Reference identified in the subcontract; (c) employees of U.S. Contractor or U.S. subcontractor firms responsible for professional services shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the U.S.; (d) goods purchased for implementation of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and (e) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in host country are not subject to the above restrictions. USTDA will make available further details concerning these standards of eligibility upon request.

NATIONALITY:

1) Rule

Except as USTDA may otherwise agree, the Contractor for USTDA funded activities must be either a U.S. firm or a U.S. individual. Prime contractors may utilize U.S.

subcontractors without limitation, but the use of host country subcontractors is limited to 20% of the USTDA grant amount.

2) Application

Accordingly, only a U.S. firm or U.S. individual may submit proposals on USTDA funded activities. Although those proposals may include subcontracting arrangements with host country firms or individuals for up to 20% of the USTDA grant amount, they may not include subcontracts with third country entities. U.S. firms submitting proposals must ensure that the professional services funded by the USTDA grant, to the extent not subcontracted to host country entities, are supplied by employees of the firm or employees of U.S. subcontractor firms who are U.S. individuals.

Interested U.S. firms and consultants who submit proposals must meet USTDA nationality requirements as of the due date for the submission of proposals and, if selected, must continue to meet such requirements throughout the duration of the USTDA-financed activity. These nationality provisions apply to whatever portion of the Terms of Reference is funded with the USTDA grant.

3) Definitions

A "U.S. individual" is (a) a U.S. citizen, or (b) a non-U.S. citizen lawfully admitted for permanent residence in the U.S. (a green card holder).

A "U.S. firm" is a privately owned firm which is incorporated in the U.S., with its principal place of business in the U.S., and which is either (a) more than 50% owned by U.S. individuals, or (b) has been incorporated in the U.S. for more than three (3) years prior to the issuance date of the request for proposals; has performed similar services in the U.S. for that three (3) year period; employs U.S. citizens in more than half of its permanent full-time positions in the U.S.; and has the existing capability in the U.S. to perform the work in question.

A partnership, organized in the U.S. with its principal place of business in the U.S., may also qualify as a "U.S. firm" as would a joint venture organized or incorporated in the United States consisting entirely of U.S. firms and/or U.S. individuals.

A nonprofit organization, such as an educational institution, foundation, or association may also qualify as a "U.S. firm" if it is incorporated in the United States and managed by a governing body, a majority of whose members are U.S. individuals.

SOURCE AND ORIGIN:

1) Rule

In addition to the nationality requirement stated above, any goods (e.g., equipment and materials) and services related to their shipment (e.g., international transportation and insurance) funded under the USTDA Grant Agreement must have their source and origin in the United States, unless USTDA otherwise agrees. However, necessary purchases of goods and project support services which are unavailable from a U.S. source (e.g., local food, housing and transportation) are eligible without specific USTDA approval.

2) Application

Accordingly, the prime contractor must be able to demonstrate that all goods and services purchased in the host country to carry out the Terms of Reference for a USTDA Grant Agreement that were not of U.S. source and origin were unavailable in the United States.

3) Definitions

"Source" means the country from which shipment is made.

"Origin" means the place of production, through manufacturing, assembly or otherwise.

Questions regarding these nationality, source and origin requirements may be addressed to the USTDA Office of General Counsel.

ANNEX 4

USTDA # 51009B

DEVELOPMENT AGENCY	
SEP - 5 2007	
AM. KE. SE. EK. JW	

GRANT AGREEMENT

This Grant Agreement is entered into between the Government of the United States of America, acting through the U.S. Trade and Development Agency ("USTDA") and the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) ("Grantee"). USTDA agrees to provide the Grantee under the terms of this Agreement US\$300,000 ("USTDA Grant") to fund the cost of goods and services required for a geotechnical feasibility study ("Study") on the proposed El Diquís Hydroelectric Power Project ("Project") in Costa Rica ("Host Country").

1 - English Spanish text

1. USTDA Funding

The funding to be provided under this Grant Agreement shall be used to fund the costs of an Agreement of Understanding between the Grantee and the U.S. firm recommended for selection by the Grantee ("Consultant") under which the Consultant will perform the Study ("Agreement of Understanding"). Payment to the Consultant will be made directly by USTDA on behalf of the Grantee with the USTDA Grant funds provided under this Grant Agreement.

2. Terms of Reference

The Terms of Reference for the Study ("Terms of Reference") are attached as Annex I and are hereby made a part of this Grant Agreement. The Study will examine the technical and other critical aspects of the proposed Project. The Terms of Reference for the Study shall also be included in the Agreement of Understanding.

3. Standards of Conduct

USTDA and the Grantee recognize the existence of standards of conduct for public officials, and commercial entities, in their respective countries. The parties to this Grant Agreement and the Consultant shall observe these standards, which include not accepting payment of money or anything of value, directly or indirectly, from any person for the purpose of illegally or improperly inducing anyone to take any action favorable to any party in connection with the Study.

4. Grantee Responsibilities

The Grantee shall undertake its best efforts to provide reasonable support for the Consultant, in accordance with the applicable laws and regulations in effect, such as local transportation, office space, and secretarial support.

5. USTDA as Financier

(A) USTDA Approval of Competitive Selection Procedures

The Grantee will recommend the selection of the U.S. Consultant according to established procedures for the competitive selection of consultants as published in the Request for Proposals (RFP) with advance notice of the procurement published in the public domain online through *Federal Business Opportunities* (www.fedbizopps.gov). Upon request, the Grantee will submit these contracting procedures and related documents to USTDA for information and approval.

(B) USTDA Approval of Recommended Consultant Selection

The Grantee shall notify USTDA at the address of record set forth in Article 17 below of the recommended selection of the Consultant to perform the Study. Upon approval of this selection by USTDA, the Grantee and the Consultant shall then enter into an Agreement of Understanding for performance of the Study. The Grantee shall notify in writing the U.S. firms that submitted unsuccessful proposals to perform the Study that they were not selected.

(C) USTDA Approval of Agreement of Understanding Between Grantee and Consultant

The Grantee and the Consultant shall enter into an Agreement of Understanding for performance of the Study. This Agreement of Understanding shall be executed in both the English and Spanish languages. The English language version shall be the binding and controlling language for all matters relating to the meaning or interpretation of the Agreement of Understanding. This Agreement of Understanding and any amendments thereto, including assignments and changes in the Terms of Reference, must be approved by USTDA in writing. To expedite this approval, the Grantee (or the Consultant on the Grantee's behalf) shall transmit to USTDA, at the address set forth in Article 17 below, a photocopy of an English language version of the signed contract or a final negotiated draft version of the Agreement of Understanding.

(D) USTDA Not a Party to the Agreement of Understanding

It is understood by the parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of the Agreement of Understanding and any amendments thereto, including assignments, the selection of all consultants, the Terms of Reference, the Final Report, and any and all documents related to the Agreement of Understanding funded under the Grant Agreement. The parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and that any decision by USTDA to exercise or refrain from exercising these approval rights shall be made as a financier in the course of funding the Study and shall not be construed as making USTDA a party to the Agreement of Understanding. The parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters related to these

rights and the Project with the parties to the Agreement of Understanding, or any subcontract, jointly or separately, without thereby incurring any responsibility or liability to such parties. Any approval or failure to approve by USTDA shall not bar the Grantee or USTDA from asserting any right they might have against the Consultant, or relieve the Consultant of any liability which the Consultant might otherwise have to the Grantee or USTDA.

(E) Grant Agreement Controlling

Regardless of USTDA approval, the rights and obligations of any party to the Agreement of Understanding or subcontract thereunder must be consistent with this Grant Agreement. In the event of any inconsistency between the Grant Agreement and any Agreement of Understanding or subcontract funded by the Grant Agreement, the Grant Agreement shall be controlling.

6. Disbursement Procedures

(A) USTDA Approval of Agreement of Understanding Required

USTDA will make disbursements of Grant funds directly to the Consultant after USTDA approves the Grantee's Agreement of Understanding with the Consultant.

(B) Consultant Invoice Requirements

The Grantee should request disbursement of funds by USTDA to the Consultant for performance of the Study by submitting invoices in accordance with the procedures set forth in the USTDA Mandatory Clauses in Annex II.

7. Effective Date

The effective date of this Grant Agreement ("Effective Date") shall be the date of signature by both parties or, if the parties sign on different dates, the date of the last signature.

8. Study Schedule

(A) Study Completion Date

The completion date for the Study, which is January 15, 2009, is the date by which the parties estimate that the Study will have been completed. In the event of a justifiable delay, the parties may request an extension of the Study Completion Date to be approved by USTDA via an Implementation Letter.

(B) Time Limitation on Disbursement of USTDA Grant Funds

Except as USTDA may otherwise agree, (a) no USTDA funds may be disbursed under this Grant Agreement for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (b) all funds made available under the Grant Agreement must be disbursed within four (4) years from the Effective Date of the Grant Agreement.

9. USTDA Mandatory Clauses

The Agreement of Understanding funded under this Grant Agreement shall include the USTDA mandatory clauses set forth in Annex II to this Grant Agreement. All subcontracts funded or partially funded with USTDA Grant funds shall include the USTDA mandatory clauses, except for clauses B(1), G, H, I, and J.

10. Use of U.S. Carriers

(A) Air

Transportation by air of persons or property funded under the Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

(B) Marine

Transportation by sea of property funded under the Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

11. Nationality, Source and Origin

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and services funded by USTDA under the Grant Agreement: (a) for professional services, the Consultant must be either a U.S. firm or U.S. individual; (b) the Consultant may use U.S. subcontractors without limitation, but the use of subcontractors from Host Country may not exceed twenty percent (20%) of the USTDA Grant amount and may only be used for specific services from the Terms of Reference identified in the subcontract; (c) employees of U.S. Consultant or U.S. subcontractor firms responsible for professional services shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the U.S.; (d) goods purchased for performance of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and (e) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions. USTDA will make available further details concerning these provisions upon request.

12. Taxes

USTDA funds provided under the Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees or other levies imposed under laws in effect in Host Country. Neither the Grantee nor the Consultant will seek reimbursement from USTDA for such taxes, tariffs, duties, fees or other levies.

13. Cooperation Between Parties and Follow-Up

The parties will cooperate to assure that the purposes of the Grant Agreement are accomplished. For five (5) years following receipt by USTDA of the Final Report (as defined in Clause I of Annex II), the Grantee agrees to respond to any reasonable inquiries from USTDA about the status of the Project.

14. Implementation Letters

To assist the Grantee in the implementation of the Study, USTDA may, from time to time, issue implementation letters that will provide additional information about matters covered by the Grant Agreement. The parties may also use jointly agreed upon implementation letters to confirm and record their mutual understanding of matters covered by the Grant Agreement.

15. Recordkeeping and Audit

The Grantee agrees to maintain books, records, and other documents relating to the Study and the Grant Agreement adequate to demonstrate implementation of its responsibilities under the Grant Agreement, including the selection of consultants, receipt and approval of Agreement of Understanding deliverables, and approval or disapproval of consultant invoices for payment by USTDA. Such books, records, and other documents shall be separately maintained for three (3) years after the date of the final disbursement by USTDA. The Grantee shall afford USTDA or its authorized representatives the opportunity at reasonable times to review books, records, and other documents relating to the Study and the Grant Agreement.

16. Representation of Parties

For all purposes relevant to the Grant Agreement, the U.S. Trade and Development Agency will be represented by the Acting Director, Leocadia I. Zak and the Grantee will be represented by the Executive President of ICE, Sr. Pedro Pablo Quirós Cortés. The parties hereto may, by written notice, designate additional representatives for all purposes under the Grant Agreement.

17. Addresses of Record for Parties

Any notice, request, document, or other communication submitted by either party to the other under the Grant Agreement shall be in writing or through a wire or electronic medium which produces a tangible record of the transmission, such as a telegram, cable or facsimile, and will be deemed duly given or sent when delivered to such party at the following:

To: Pedro Pablo Quirós Cortés
Presidente Ejecutivo del Instituto Costarricense de Electricidad
Instituto Costarricense de Electricidad (ICE)
Apartado 10032-1000
San José, Costa Rica

Attention: Unidad Gestión de Proyectos
Subgerencia Sector Electricidad

Tel: (506) 220 7940
Fax: (506) 220 8233

To: U.S. Trade and Development Agency
1000 Wilson Boulevard, Suite 1600
Arlington, Virginia 22209-3901
USA

Tel: (703) 875-4357
Fax: (703) 875-4009

All such communications shall be in English, unless the parties otherwise agree in writing. In addition, the Grantee shall provide the Commercial Section of the U.S. Embassy in Host Country with a copy of each communication sent to USTDA.

Any communication relating to this Grant Agreement shall include the following fiscal data:

Appropriation No.: 117/81001
Activity No.: 2007-51009B
Reservation No.: 2007510027
Grant No.: GH2007510005

18. Termination Clause

Either party may terminate the Grant Agreement by giving the other party thirty (30) days advance written notice. The termination of the Grant Agreement will end any obligations of the parties to provide financial or other resources for the Study, except for payments which they are committed to make pursuant to noncancellable commitments entered into with third parties prior to the written notice of termination.

19. Non-waiver of Rights and Remedies

No delay in exercising any right or remedy accruing to either party in connection with the Grant Agreement shall be construed as a waiver of such right or remedy.

20. U.S. Technology and Equipment

By funding this Study, USTDA seeks to promote the project objectives of the Host Country through the use of U.S. technology, goods, and services. In recognition of this purpose, the Grantee agrees that it will allow U.S. suppliers to compete in the procurement of technology, goods and services needed for Project implementation.

[THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK]

IN WITNESS WHEREOF, the U.S. Trade and Development Agency and the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE), each acting through its duly authorized representative, have caused this Agreement to be signed in English and Spanish in their names and delivered as of the day and year written below. In the event that this Grant Agreement is signed in more than one language, the English language version shall govern.

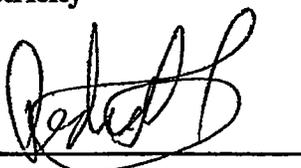
For the U.S. Trade and Development Agency

By: 

Leocadia I. Zak

Date: 29/08/07

For the Costa Rican Institute of Electricity

By: 

Pedro Pablo Quirós Cortés

Date: 03/09/07

Annex I -- Terms of Reference

Annex II -- USTDA Mandatory Clauses

Annex I

Terms of Reference

The objective of the Feasibility Study ("Study") is to perform geotechnical investigations at specific portions of the Project site in order to refine the existing geological and geotechnical model along the tunnel axis and in the powerhouse area. This requires (1) performing hydraulic fracturing tests in the powerhouse area to measure the magnitude and direction of stress in the foundation rock formation, and (2) performing geophysical investigations along the tunnel axis. The Contractor shall process and interpret the data by refining the current technical model and incorporate the findings into Draft Reports. An additional component incorporates training of the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) staff on the results and procedures of this Study.

Task 1: Preliminary Matters, Preliminary Report and Kick-off Meeting

- 1.1 The Consultant shall request that ICE appoint a Designated Representative who shall be the formal and official point of contact between the Consultant and ICE.
- 1.2 The Consultant shall deliver a preliminary report to ICE prior to beginning any site work which shall include the work plan, technical aspects, and administrative matters related to quality assurance and quality control during performance of the Agreement of Understanding.
- 1.3 The Consultant shall convene a meeting with the ICE Project staff to determine a timeline for Study completion and determine the elements of the Study in which ICE staff will partake.

Deliverable: Work Plan (five print copies and an electronic version including all files in editable format)

Task 2: Drilling and Hydraulic Fracturing Tests

This Task is designed to measure the current state of stress, both magnitude and direction, present in the foundation rock, so that information can be utilized in the design of the powerhouse, the intake tunnel and the conveyance tunnel.

- 2.1 The Consultant shall make recommendations for proper orientation of the powerhouse and the structural support required for the powerhouse, the intake tunnel and the conveyance tunnel. The Consultant shall supply information relevant to the construction process. The Consultant shall perform this Task at the location of the powerhouse and intake tunnel of the Project, near Palmar Norte. The Consultant shall, after consultation with ICE, decide which access route to use to reach the drilling site. The Consultant shall consider the following access routes:

Cuesta del burro

The entrance to this route is located approximately 10 km to the west of Palmar Norte, along the Costanera Sur Highway. It is approximately 22.5 kilometers long, gravel-surfaced with an average depth of 4 m and passable year-round. The last 2 km of this route, which ends at borehole PHB-RG-11-CM, becomes a trail with very irregular topography and is not suitable for motor vehicles.

Finca Camaronal

The entrance to this route is located approximately 4 km from Palmar Norte, along the Costanera Sur Highway. The first section of this route, with a length of 500 m, is gravel-surfaced and passable year-round; thereafter there is a section with a length of 2.9 km that is passable only in the summer dry season. The final section is a trail of 1.5 km, leading to borehole PHB-RG-12-CM, that is not suitable for motor vehicles.

Barrio Alemania

This route begins to the north of Barrio Alemania of Palmar Norte, with two sections. The first is a 700 m long gravel-surfaced road with 4 m depth, passable year-round, which extends from Barrio Alemania to the storage tanks for the Palmar Norte aqueduct. The second section is a 1.8 km long trail that is difficult to access at any time of the year.

- 2.2 The Consultant shall drill two boreholes of 500 m depth, in which the hydraulic tests will be performed. The boreholes shall have a diameter of approximately 3 inches or 76 mm, and shall be carried to a depth of at least 500 m. To prevent the loss of fragments in the shallow stages of drilling, the Consultant shall use casing. The Consultant shall grout the remaining unstable segments to ensure that falling fragments cannot damage the instruments and equipment. The Consultant shall provide his own equipment, labor and services necessary to drill the boreholes and perform the hydraulic fracturing tests, as well as the equipment and software to obtain and then interpret the resulting data.
- 2.3 The Consultant shall make available all drilling logs and core samples to ICE for its inspection and review.
- 2.4 The Consultant shall work in coordination with ICE to determine the exact location and depth at which the tests shall be performed taking into consideration (a) the drilling data from the borehole, (b) inspection of recovered core samples, and (c) confirmation that the testing fully characterizes the lithology in the areas in which the civil works will be performed.
- 2.5 The Consultant shall conduct the planning, performance and data processing for the hydraulic testing of previous fractures ("HTPF") and the installation of local seismic detection networks installed by ICE. The Consultant shall perform four hydraulic fracturing tests in each of the boreholes in accordance with ASTM Standard Test Method D4645 "Determination of the In Situ Stress in Rock Using the Hydraulic Fracturing Method".

- 2.6 Upon completion of the hydraulic testing, the Consultant shall report on the magnitude and direction of the stress present in the foundation rock, to support the design of the powerhouse, the intake tunnel and the conveyance tunnel of the Project site.
- 2.7 The Consultant shall carry out the processing and interpretation of the data from the drilling and hydraulic fracturing tests at the Project site and at the offices at ICE's Project and Support Services Building.

Task 3: Draft Report on Hydraulic Fracturing

- 3.1 The Consultant shall write and submit a Draft Report on Hydraulic Fracturing to ICE for review and comment. The Draft Report shall include the following:
- Drilling of Boreholes
 - Description of Equipment Used
 - Description of Drilling Logs and Results
 - Photographic Record of Core Recovery
 - Hydraulic Fracturing Tests
 - Procedures and Performance of Fieldwork
 - Data Obtained (including a listing and classification of the original data)
 - Analysis and Interpretation of Test Results
 - Discussion of the Results and Their Relevance to the Design and Location of the Project
 - Conclusions and Recommendations

Deliverable: Draft Report on Hydraulic Fracturing (10 printed and bound copies and 10 copies in electronic format recorded on CD)

Task 4: Geophysical Investigations

- 4.1 The Consultant shall perform seismic studies to characterize the lithology along the longitudinal axis of the tunnel. ICE shall provide the equipment and the field personnel to perform this testing. The Consultant shall coordinate all logistics associated with the utilization of such resources.
- 4.2 The Consultant shall obtain seismic sections in two dimensions, oriented along the Northeast/southwest axis of the tunnel, in two sectors. The Consultant shall interpret and model the data to support the construction planning for the tunnel, including characterization of the rock types likely to be encountered during construction and indicating the zones of weakness (including but not limited to, faults, discontinuities, intrusions).
- 4.3 The Consultant shall perform the planning, performance and data processing for the geophysical studies in two sectors along the axis of the conveyance tunnel: the first sector will encompass the stations 2+600 through 5+000; the second sector will encompass the stations 10+000 to 13+200. The two sectors combined comprise a total length of 5600 m.

The Consultant shall carry out seismic profiling at a depth of between 1000 and 1500 m. The Consultant shall carry out the geophysical fieldwork between Pejibaye de Pérez Zeledón and Palmar Norte. The Consultant shall carry out the processing and interpretation of the seismic reflection data at the central offices of ICE.

Task 5: Draft Report on Geophysical Investigations

5.1 The Consultant shall write and deliver a Draft Report on Geophysical Investigations to ICE for review and comment. The Draft Report shall include, at a minimum, the following:

- Methodology for Processing Data from Geophysical Testing
- Profiles Resulting from Interpretation of Seismic Reflection Studies
- Structural Characteristics of Particular Interest or Concern in the Segments Studied, Such As Faults and Geological Discontinuities (Anomalies, Stratigraphy, Intrusions, etc.)
- Prediction of Zones Along the Tunnel Axis Most Likely to Cause Construction Difficulties
- Physical Parameters, Such As Modulus of Elasticity and Other Characteristics, of the Foundation Rock
- Recommendations for Temporary Support and Shoring of the Tunnel During the Construction Process
- Conclusions and Recommendations

Deliverable: A Draft Report on Geophysical Investigations (10 printed and bound copies and 10 copies in electronic format recorded on CD)

Task 6: Training Seminars

6.1 The Consultant shall provide training for up to 30 ICE professionals at ICE Headquarters, in Spanish, that will cover the performance of all phases of the hydraulic fracturing. The training shall include a two-day course that covers both performance of the tests and interpretation of the resulting data. In addition, the Consultant shall provide a one-hour seminar on case studies in which hydraulic fracturing has been used as a design tool for subterranean excavation. The Consultant shall supply training in a multimedia presentation (CD format) and a three-ring binder with color copies of all presentation slides for each participant.

6.2 The Consultant shall provide training for up to 30 ICE professionals at ICE Headquarters, in Spanish, that will cover the performance of all phases of the geophysical investigations. The training shall include a two-day course that covers both the investigations and interpretation of the resulting data. The Consultant shall supply training in a multimedia presentation (CD format) and a three-ring binder with color copies of all presentation slides for each participant.

Deliverable: Multimedia presentation (in CD format) and three-ring binder with color copies of all training materials for both hydraulic fracturing tests and geophysical investigations.

Task 7: Final Report

- 7.1 The Consultant shall submit a Draft Final Report to ICE for comment. After submitting the Draft Final Report to ICE, the Consultant shall travel to ICE headquarters to make an oral presentation to ICE. The Consultant shall draft and document modifications and clarifications which may be necessary pursuant to the request of ICE and in accordance with the requirements of these Terms of Reference. Upon receipt of comments from ICE, the Consultant shall revise and incorporate the relevant comments into the Final Report.
- 7.2 The Consultant shall prepare and deliver to ICE and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to ICE, including Draft Reports. The Final Report shall be prepared in accordance with Clause I of Annex II of the Grant Agreement. It shall be prepared in English and Spanish.
- 7.3 The Consultant shall deliver to ICE one original and nine copies of the Final Report along with 10 copies in electronic form recorded on CD. The Consultant shall deliver the Final Report to USTDA in accordance with Clause I of Annex II of the Grant Agreement.

Notes:

- (1) **The Consultant is responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.**
- (2) **The Consultant and the Grantee shall be careful to ensure that the public version of the Final Report contains no security or confidential information.**
- (3) **The Grantee and USTDA shall have an irrevocable, worldwide, royalty-free, non-exclusive right to use and distribute the Final Report and all work product that is developed under these Terms of Reference.**

Annex II

USTDA Mandatory Clauses for Agreement of Understanding

A. USTDA Mandatory Clauses Controlling

The parties to this Agreement of Understanding acknowledge that this Agreement of Understanding is funded in whole or in part by the U.S. Trade and Development Agency ("USTDA") under the Grant Agreement between USTDA and the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) ("Grantee"), dated _____ ("Grant Agreement"). The Client has selected _____ ("Consultant") to perform the geotechnical feasibility study ("Study") of the El Diquís Hydroelectric Power Project ("Project") in Costa Rica ("Host Country"). Notwithstanding any other provisions of this Agreement of Understanding, the following USTDA mandatory clauses shall govern. All subcontracts entered into by Consultant funded or partially funded with USTDA Grant funds shall include these USTDA mandatory clauses, except for clauses B(1), G, H, I, and J. In addition, in the event of any inconsistency between the Grant Agreement and any Agreement of Understanding or subcontract thereunder, the Grant Agreement shall be controlling.

B. USTDA as Financier

(1) USTDA Approval of Agreement of Understanding

The Agreement of Understanding funded under the Grant Agreement, and any amendments thereto, including assignments and changes in the Terms of Reference, must be approved by USTDA in writing in order to be effective with respect to the expenditure of USTDA Grant funds. USTDA will not authorize the disbursement of USTDA Grant funds until the Agreement of Understanding has been formally approved by USTDA or until the Agreement of Understanding conforms to modifications required by USTDA during the review process.

(2) USTDA Not a Party to the Agreement of Understanding

It is understood by the parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of this Agreement of Understanding and amendments thereto, including assignments, the selection of all consultants, the Terms of Reference, the Final Report, and any and all documents related to the Agreement of Understanding funded under the Grant Agreement. The parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and that any decision by USTDA to exercise or refrain from exercising these approval rights shall be made as a financier in the course of financing the Study and shall not be construed as making USTDA a party to the Agreement of Understanding. The parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters

related to these rights and the Project with the parties to the Agreement of Understanding or any subcontract, jointly or separately, without thereby incurring any responsibility or liability to such parties. Any approval or failure to approve by USTDA shall not bar the Grantee or USTDA from asserting any right they might have against the Consultant, or relieve the Consultant of any liability which the Consultant might otherwise have to the Grantee or USTDA.

C. Nationality, Source and Origin

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and services funded by USTDA under the Grant Agreement: (a) for professional services, the Consultant must be either a U.S. firm or U.S. individual; (b) the Consultant may use U.S. subcontractors without limitation, but the use of subcontractors from Host Country may not exceed twenty percent (20%) of the USTDA Grant amount and may only be used for specific services from the Terms of Reference identified in the subcontract; (c) employees of U.S. Consultant or U.S. subcontractor firms responsible for professional services shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the U.S.; (d) goods purchased for performance of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and (e) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions. USTDA will make available further details concerning these provisions upon request.

D. Recordkeeping and Audit

The Consultant and subcontractors funded under the Grant Agreement shall maintain, in accordance with generally accepted accounting procedures, books, records, and other documents, sufficient to reflect properly all transactions under or in connection with the Agreement of Understanding. These books, records, and other documents shall clearly identify and track the use and expenditure of USTDA funds, separately from other funding sources. Such books, records, and documents shall be maintained during the term of the Agreement of Understanding and for a period of three (3) years after final disbursement by USTDA. The Consultant and subcontractors shall afford USTDA, or its authorized representatives, the opportunity at reasonable times for inspection and audit of such books, records, and other documentation.

E. U.S. Carriers

(1) Air

Transportation by air of persons or property funded under the Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

(2) Marine

Transportation by sea of property funded under the Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

F. Workman's Compensation Insurance

The Consultant shall provide adequate Workman's Compensation Insurance coverage for work performed under this Agreement of Understanding.

G. Reporting Requirements

The Consultant shall advise USTDA by letter as to the status of the Project on March 1st annually for a period of two (2) years after completion of the Study. In addition, if at any time the Consultant receives follow-on work from the Grantee, the Consultant shall so notify USTDA and designate the Consultant's contact point including name, telephone, and fax number. Since this information may be made publicly available by USTDA, any information which is confidential shall be designated as such by the Consultant and provided separately to USTDA. USTDA will maintain the confidentiality of such information in accordance with applicable law.

H. Disbursement Procedures

(1) USTDA Approval of Agreement of Understanding

Disbursement of Grant funds will be made only after USTDA approval of this Agreement of Understanding. To make this review in a timely fashion, USTDA must receive from either the Grantee or the Consultant a photocopy of an English language version of a signed contract or a final negotiated draft version to the attention of the General Counsel's office at USTDA's address listed in Clause M below.

(2) Payment Schedule Requirements

A payment schedule for disbursement of Grant funds to the Consultant shall be included in this Agreement of Understanding. Such payment schedule must conform to the following USTDA requirements: (1) up to twenty percent (20%) of the total USTDA Grant amount may be used as an advance payment; (2) all other payments, with the exception of the final payment, shall be based upon Agreement of Understanding performance milestones; and (3) the final payment may be no less than fifteen percent (15%) of the total USTDA Grant amount, payable upon receipt by USTDA of an approved Final Report in accordance with the specifications and quantities set forth in Clause I below. Invoicing procedures for all payments are described below.

(3) Consultant Invoice Requirements

USTDA will make all disbursements of USTDA Grant funds directly to the Consultant. The Consultant must provide USTDA with an ACH Vendor Enrollment Form (available from USTDA) with the first invoice. The Grantee shall request disbursement of funds by USTDA to the Consultant for performance of the Agreement of Understanding by submitting the following to USTDA:

(a) Consultant's Invoice

The Consultant's invoice shall include reference to an item listed in the Agreement of Understanding payment schedule, the requested payment amount, and an appropriate certification by the Consultant, as follows:

(i) For an advance payment (if any):

"As a condition for this advance payment, which is an advance against future Study costs, the Consultant certifies that it will perform all work in accordance with the terms of its Agreement of Understanding with the Grantee. To the extent that the Consultant does not comply with the terms and conditions of the Agreement of Understanding, including the USTDA mandatory provisions contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(ii) For Agreement of Understanding performance milestone payments:

"The Consultant has performed the work described in this invoice in accordance with the terms of its Agreement of Understanding with the Grantee and is entitled to payment thereunder. To the extent the Consultant has not complied with the terms and conditions of the Agreement of Understanding, including the USTDA mandatory provisions contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(iii) For final payment:

"The Consultant has performed the work described in this invoice in accordance with the terms of its Agreement of Understanding with the Grantee and is entitled to payment thereunder. Specifically, the Consultant has submitted the Final Report to the Grantee, as required by the Agreement of Understanding, and received the Grantee's approval of the Final Report. To the extent the Consultant has not complied with the terms and conditions of the Agreement of Understanding, including the USTDA mandatory provisions contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(b) Grantee's Approval of the Consultant's Invoice

(i) The invoice for an advance payment must be approved in writing by the Grantee.

(ii) For Agreement of Understanding performance milestone payments, the following certification by the Grantee must be provided on the invoice or separately:

"The services for which disbursement is requested by the Consultant have been performed satisfactorily, in accordance with applicable Agreement of Understanding provisions and the terms and conditions of the USTDA Grant Agreement."

(iii) For final payment, the following certification by the Grantee must be provided on the invoice or separately:

"The services for which disbursement is requested by the Consultant have been performed satisfactorily, in accordance with applicable Agreement of Understanding provisions and terms and conditions of the USTDA Grant Agreement. The Final Report submitted by the Consultant has been reviewed and approved by the Grantee. "

(c) USTDA Address for Disbursement Requests

Requests for disbursement shall be submitted by courier or mail to the attention of the Finance Department at USTDA's address listed in Clause M below.

(4) Termination

In the event that the Agreement of Understanding is terminated prior to completion, the Consultant will be eligible, subject to USTDA approval, for reasonable and documented costs which have been incurred in performing the Terms of Reference prior to termination, as well as reasonable wind down expenses. Reimbursement for such costs shall not exceed the total amount of undisbursed Grant funds. Likewise, in the event of such termination, USTDA is entitled to receive from the Consultant all USTDA Grant funds previously disbursed to the Consultant (including but not limited to advance payments) which exceed the reasonable and documented costs incurred in performing the Terms of Reference prior to termination.

I. USTDA Final Report

(1) Definition

"Final Report" shall mean the Final Report described in the attached Annex I Terms of Reference or, if no such "Final Report" is described therein, "Final Report" shall mean a substantive and comprehensive report of work performed in accordance with the attached Annex I Terms of Reference, including any documents delivered to the Grantee.

(2) Final Report Submission Requirements

The Consultant shall provide the following to USTDA:

(a) One (1) complete version of the Final Report for USTDA's records. This version shall have been approved by the Grantee in writing and must be in the English language. It is the responsibility of the Consultant to ensure that confidential information, if any, contained in this version be clearly marked. USTDA will maintain the confidentiality of such information in accordance with applicable law.

and

(b) Three (3) copies of the Final Report suitable for public distribution ("Public Version"). The Public Version shall have been approved by the Grantee in writing and must be in the English language. As this version will be available for public distribution, it must not contain any confidential information. If the report in (a) above contains no confidential information, it may be used as the Public Version (provided USTDA receives a total of four (4) copies). In any event, the Public Version must be informative and contain sufficient Project detail to be useful to prospective equipment and service providers.

The Contractor shall also provide one (1) copy of the Public Version of the Final Report to the Foreign Commercial Service Officer or the Economic Section of the U.S. Embassy in Host Country for informational purposes.

(3) Final Report Presentation

All Final Reports submitted to USTDA must be paginated and include the following:

(a) The front cover of every Final Report shall contain the name of the Grantee, the name of the Consultant who prepared the report, a report title, USTDA's logo, USTDA's mailing and delivery addresses, and the following disclaimer:

"This report was funded by the U.S. Trade and Development Agency (USTDA), an agency of the U. S. Government. The opinions, findings, conclusions or recommendations expressed in this document are those of the author(s) and do not necessarily represent the official position or policies of USTDA. USTDA makes no representation about, nor does it accept responsibility for, the accuracy or completeness of the information contained in this report."

(b) The inside front cover of every Final Report shall contain USTDA's logo, USTDA's mailing and delivery addresses, and USTDA's mission statement. Camera-ready copy of USTDA Final Report specifications will be available from USTDA upon request.

(c) The Consultant and any subcontractor that performs work pursuant to the Grant Agreement must be clearly identified in the Final Report. Business name, point of contact, address, telephone and fax numbers shall be included for Consultant and each subcontractor.

(d) The Final Report, while aiming at optimum specifications and characteristics for the Project, shall identify the availability of prospective U.S. sources of supply. Business name, point of contact, address, telephone and fax numbers shall be included for each commercial source.

(e) The Final Report shall be accompanied by a letter or other notation by the Grantee which states that the Grantee approves the Final Report. A certification by the Grantee to this effect provided on or with the invoice for final payment will meet this requirement.

J. Modifications

All changes, modifications, assignments or amendments to this Agreement of Understanding including the appendices, shall be made only by written agreement by the parties hereto, subject to written USTDA approval.

K. Study Schedule

(1) Study Completion Date

The completion date for the Study, which is January 15, 2009, is the date by which the parties estimate that the Study will have been completed.

(2) Time Limitation on Disbursement of USTDA Grant Funds

Except as USTDA may otherwise agree, (a) no USTDA funds may be disbursed under this Agreement of Understanding for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (b) all funds made available under the Grant Agreement must be disbursed within four (4) years from the Effective Date of the Grant Agreement.

L. Business Practices

The Consultant agrees not to pay, promise to pay, or authorize the payment of any money or anything of value, directly or indirectly, to any person (whether a governmental official or private individual) for the purpose of illegally or improperly inducing anyone to take any action favorable to any party in connection with the Study. The Grantee agrees not to receive any such payment. The Consultant and the Grantee agree that each will require that any agent or representative hired to represent them in connection with the Study will comply with this paragraph and all laws which apply to activities and obligations of each party under this Agreement of Understanding, including but not limited to those laws and obligations dealing with improper payments as described above.

M. USTDA Address and Fiscal Data

Any communication with USTDA regarding this Agreement of Understanding shall be sent to the following address and include the fiscal data listed below:

U.S. Trade and Development Agency
1000 Wilson Boulevard, Suite 1600
Arlington, Virginia 22209-3901
USA

Phone: (703) 875-4357
Fax: (703) 875-4009

Fiscal Data:

Appropriation No.: 117/81001
Activity No.: 2007-51009B
Reservation No.: 2007510027
Grant No.: GH2007510005

N. Definitions

All capitalized terms not otherwise defined herein shall have the meaning set forth in the Grant Agreement.

O. Taxes

USTDA funds provided under the Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees or other levies imposed under laws in effect in Host Country. Neither the Grantee nor the Consultant will seek reimbursement from USTDA for such taxes, tariffs, duties, fees or other levies.

ANNEX 5

Annex I

Terms of Reference

The objective of the Feasibility Study ("Study") is to perform geotechnical investigations at specific portions of the Project site in order to refine the existing geological and geotechnical model along the tunnel axis and in the powerhouse area. This requires (1) performing hydraulic fracturing tests in the powerhouse area to measure the magnitude and direction of stress in the foundation rock formation, and (2) performing geophysical investigations along the tunnel axis. The Contractor shall process and interpret the data by refining the current technical model and incorporate the findings into Draft Reports. An additional component incorporates training of the Costa Rican Institute of Electricity (Instituto Costarricense de Electricidad, ICE) staff on the results and procedures of this Study.

Task 1: Preliminary Matters, Preliminary Report and Kick-off Meeting

- 1.1 The Consultant shall request that ICE appoint a Designated Representative who shall be the formal and official point of contact between the Consultant and ICE.
- 1.2 The Consultant shall deliver a preliminary report to ICE prior to beginning any site work which shall include the work plan, technical aspects, and administrative matters related to quality assurance and quality control during performance of the Agreement of Understanding.
- 1.3 The Consultant shall convene a meeting with the ICE Project staff to determine a timeline for Study completion and determine the elements of the Study in which ICE staff will partake.

Deliverable: Work Plan (five print copies and an electronic version including all files in editable format)

Task 2: Drilling and Hydraulic Fracturing Tests

This Task is designed to measure the current state of stress, both magnitude and direction, present in the foundation rock, so that information can be utilized in the design of the powerhouse, the intake tunnel and the conveyance tunnel.

- 2.1 The Consultant shall make recommendations for proper orientation of the powerhouse and the structural support required for the powerhouse, the intake tunnel and the conveyance tunnel. The Consultant shall supply information relevant to the construction process. The Consultant shall perform this Task at the location of the powerhouse and intake tunnel of the Project, near Palmar Norte. The Consultant shall, after consultation with ICE, decide which access route to use to reach the drilling site. The Consultant shall consider the following access routes:

Cuesta del burro

The entrance to this route is located approximately 10 km to the west of Palmar Norte, along the Costanera Sur Highway. It is approximately 22.5 kilometers long, gravel-surfaced with an average depth of 4 m and passable year-round. The last 2 km of this route, which ends at borehole PHB-RG-11-CM, becomes a trail with very irregular topography and is not suitable for motor vehicles.

Finca Camaronal

The entrance to this route is located approximately 4 km from Palmar Norte, along the Costanera Sur Highway. The first section of this route, with a length of 500 m, is gravel-surfaced and passable year-round; thereafter there is a section with a length of 2.9 km that is passable only in the summer dry season. The final section is a trail of 1.5 km, leading to borehole PHB-RG-12-CM, that is not suitable for motor vehicles.

Barrio Alemania

This route begins to the north of Barrio Alemania of Palmar Norte, with two sections. The first is a 700 m long gravel-surfaced road with 4 m depth, passable year-round, which extends from Barrio Alemania to the storage tanks for the Palmar Norte aqueduct. The second section is a 1.8 km long trail that is difficult to access at any time of the year.

- 2.2 The Consultant shall drill two boreholes of 500 m depth, in which the hydraulic tests will be performed. The boreholes shall have a diameter of approximately 3 inches or 76 mm, and shall be carried to a depth of at least 500 m. To prevent the loss of fragments in the shallow stages of drilling, the Consultant shall use casing. The Consultant shall grout the remaining unstable segments to ensure that falling fragments cannot damage the instruments and equipment. The Consultant shall provide his own equipment, labor and services necessary to drill the boreholes and perform the hydraulic fracturing tests, as well as the equipment and software to obtain and then interpret the resulting data.
- 2.3 The Consultant shall make available all drilling logs and core samples to ICE for its inspection and review.
- 2.4 The Consultant shall work in coordination with ICE to determine the exact location and depth at which the tests shall be performed taking into consideration (a) the drilling data from the borehole, (b) inspection of recovered core samples, and (c) confirmation that the testing fully characterizes the lithology in the areas in which the civil works will be performed.
- 2.5 The Consultant shall conduct the planning, performance and data processing for the hydraulic testing of previous fractures ("HTPF") and the installation of local seismic detection networks installed by ICE. The Consultant shall perform four hydraulic fracturing tests in each of the boreholes in accordance with ASTM Standard Test Method D4645 "Determination of the In Situ Stress in Rock Using the Hydraulic Fracturing Method".

- 2.6 Upon completion of the hydraulic testing, the Consultant shall report on the magnitude and direction of the stress present in the foundation rock, to support the design of the powerhouse, the intake tunnel and the conveyance tunnel of the Project site.
- 2.7 The Consultant shall carry out the processing and interpretation of the data from the drilling and hydraulic fracturing tests at the Project site and at the offices at ICE's Project and Support Services Building.

Task 3: Draft Report on Hydraulic Fracturing

- 3.1 The Consultant shall write and submit a Draft Report on Hydraulic Fracturing to ICE for review and comment. The Draft Report shall include the following:
- Drilling of Boreholes
 - Description of Equipment Used
 - Description of Drilling Logs and Results
 - Photographic Record of Core Recovery
 - Hydraulic Fracturing Tests
 - Procedures and Performance of Fieldwork
 - Data Obtained (including a listing and classification of the original data)
 - Analysis and Interpretation of Test Results
 - Discussion of the Results and Their Relevance to the Design and Location of the Project
 - Conclusions and Recommendations

Deliverable: Draft Report on Hydraulic Fracturing (10 printed and bound copies and 10 copies in electronic format recorded on CD)

Task 4: Geophysical Investigations

- 4.1 The Consultant shall perform seismic studies to characterize the lithology along the longitudinal axis of the tunnel. ICE shall provide the equipment and the field personnel to perform this testing. The Consultant shall coordinate all logistics associated with the utilization of such resources.
- 4.2 The Consultant shall obtain seismic sections in two dimensions, oriented along the Northeast/southwest axis of the tunnel, in two sectors. The Consultant shall interpret and model the data to support the construction planning for the tunnel, including characterization of the rock types likely to be encountered during construction and indicating the zones of weakness (including but not limited to, faults, discontinuities, intrusions).
- 4.3 The Consultant shall perform the planning, performance and data processing for the geophysical studies in two sectors along the axis of the conveyance tunnel: the first sector will encompass the stations 2+600 through 5+000; the second sector will encompass the stations 10+000 to 13+200. The two sectors combined comprise a total length of 5600 m.

The Consultant shall carry out seismic profiling at a depth of between 1000 and 1500 m. The Consultant shall carry out the geophysical fieldwork between Pejibaye de Pérez Zeledón and Palmar Norte. The Consultant shall carry out the processing and interpretation of the seismic reflection data at the central offices of ICE.

Task 5: Draft Report on Geophysical Investigations

5.1 The Consultant shall write and deliver a Draft Report on Geophysical Investigations to ICE for review and comment. The Draft Report shall include, at a minimum, the following:

- Methodology for Processing Data from Geophysical Testing
- Profiles Resulting from Interpretation of Seismic Reflection Studies
- Structural Characteristics of Particular Interest or Concern in the Segments Studied, Such As Faults and Geological Discontinuities (Anomalies, Stratigraphy, Intrusions, etc.)
- Prediction of Zones Along the Tunnel Axis Most Likely to Cause Construction Difficulties
- Physical Parameters, Such As Modulus of Elasticity and Other Characteristics, of the Foundation Rock
- Recommendations for Temporary Support and Shoring of the Tunnel During the Construction Process
- Conclusions and Recommendations

Deliverable: A Draft Report on Geophysical Investigations (10 printed and bound copies and 10 copies in electronic format recorded on CD)

Task 6: Training Seminars

6.1 The Consultant shall provide training for up to 30 ICE professionals at ICE Headquarters, in Spanish, that will cover the performance of all phases of the hydraulic fracturing. The training shall include a two-day course that covers both performance of the tests and interpretation of the resulting data. In addition, the Consultant shall provide a one-hour seminar on case studies in which hydraulic fracturing has been used as a design tool for subterranean excavation. The Consultant shall supply training in a multimedia presentation (CD format) and a three-ring binder with color copies of all presentation slides for each participant.

6.2 The Consultant shall provide training for up to 30 ICE professionals at ICE Headquarters, in Spanish, that will cover the performance of all phases of the geophysical investigations. The training shall include a two-day course that covers both the investigations and interpretation of the resulting data. The Consultant shall supply training in a multimedia presentation (CD format) and a three-ring binder with color copies of all presentation slides for each participant.

Deliverable: Multimedia presentation (in CD format) and three-ring binder with color copies of all training materials for both hydraulic fracturing tests and geophysical investigations.

Task 7: Final Report

- 7.1 The Consultant shall submit a Draft Final Report to ICE for comment. After submitting the Draft Final Report to ICE, the Consultant shall travel to ICE headquarters to make an oral presentation to ICE. The Consultant shall draft and document modifications and clarifications which may be necessary pursuant to the request of ICE and in accordance with the requirements of these Terms of Reference. Upon receipt of comments from ICE, the Consultant shall revise and incorporate the relevant comments into the Final Report.
- 7.2 The Consultant shall prepare and deliver to ICE and USTDA a substantive and comprehensive final report of all work performed under these Terms of Reference ("Final Report"). The Final Report shall be organized according to the above tasks, and shall include all deliverables and documents that have been provided to ICE, including Draft Reports. The Final Report shall be prepared in accordance with Clause I of Annex II of the Grant Agreement. It shall be prepared in English and Spanish.
- 7.3 The Consultant shall deliver to ICE one original and nine copies of the Final Report along with 10 copies in electronic form recorded on CD. The Consultant shall deliver the Final Report to USTDA in accordance with Clause I of Annex II of the Grant Agreement.

Notes:

- (1) The Consultant is responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.
- (2) The Consultant and the Grantee shall be careful to ensure that the public version of the Final Report contains no security or confidential information.
- (3) The Grantee and USTDA shall have an irrevocable, worldwide, royalty-free, non-exclusive right to use and distribute the Final Report and all work product that is developed under these Terms of Reference.

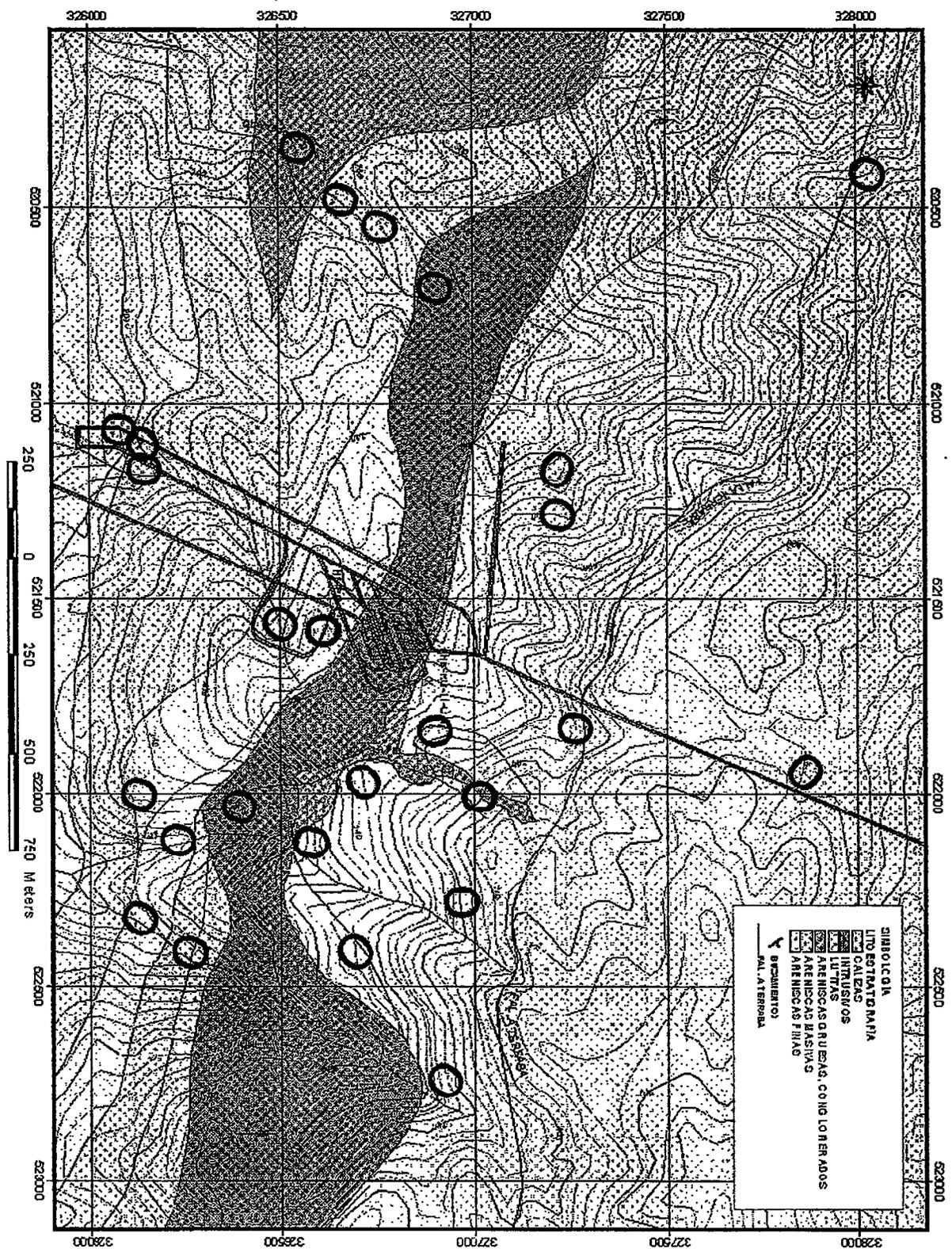
ANNEX 6

Supply of Geophysical Test Equipment

ICE shall make the following geophysical test equipment available to the Consultant upon request:

- Seismograph, type Stratavisor NZ made by Geometrics. This model has 40 channels and a 24-bit analog/digital converter.
- Seismic sensors, each with groups of nine geophones with 14 Hz bandwidth.
- Multi-conductor cables
- Roll switch.
- Augers, shovels y pickaxes for excavations.
- High velocity explosive compound and blasting caps.
- Trigger cables and safety cords.
- Walkie-talkies.
- Continuity testers.
- No.18 twin cables.

ANNEX 7



Escuela de Ingenieros
Física y Matemática

- ▲ SIMBOLICIA
- ▲ LINDERO
- ▲ ESTRECHO
- ▲ CALZADA
- ▲ INTERRUPCIÓN
- ▲ LÍNEA
- ▲ ARENICAS ORUGAS, CONGLOMERADOS
- ▲ ARENICAS MASIVAS
- ▲ ARENICAS FINAS
- ▲ RECAMBIOS
- ▲ PAL. A TERRELLA

ANNEX 8

Prior Geological Studies at the Site

Information available to ICE indicates that the location of the powerhouse where the hydraulic fracturing tests will take place is characterized by a series of sedimentary materials corresponding to limestones of the Fila de Cal formation and sandstone, shale and breccia of the Térraba formation. In places this formation also includes intrusive igneous rock, i.e., gabbro, corresponding to the Puerto Nuevo formation. A geological map of the area is attached.

Based on data from earthquake monitors, as well as kinematic sensors in mesoscopic faults at various representative depths, the maximum horizontal stress at both a regional and local scale is estimated to be, on average, oriented N33°E. In addition, the relative and absolute magnitude of the stress has been estimated at various depths. However, because of the relative tectonic complexity of the formation, there are probably major variations in the direction of the stress near the regional faults, and the Cordillera Costeña may also be causing deflections, so it is therefore necessary to perform the testing *in situ*.

Three boreholes have been drilled to date in this area, the first with a depth of 165 m (PH-RG-09-CM), the second with a depth of 501 m (PH-RG-11-CM), and a third with a depth of 490 m (PH-RG-10-CM).

Borehole PHB-RG-09-CM encountered materials of the Térraba formation, as shown in the attachment. Core recovery percentage and Rock Quality Determination (RQD) were both very low to depths of 55 m, with an RQD of 0%. From 55m to 100m the RQD improved, with only a few sections which were highly fractured and in which the RQD percentage was reduced. From 100 m to 165 m the quality of the material was considerably improved and the RQD was higher than 75% in virtually all of the core samples.

With respect to the phreatic level, through the shallow drilling process it maintained a relatively constant level at an average depth of 56 m, as shown in the attached figure.

As it was not possible to complete borehole PHB-RG-09-CM due to technical problems, a second borehole (PHB-RG-11-CM) was drilled at a nearby location. The second borehole reached a depth of 501 m and intersected layers of sandstone and shale in the Térraba formation and reached the intrusions of the Puerto Nuevo formation, as can be seen in the attachment. For this borehole a tricone rock bit was used for the shallow drilling and therefore no core was recovered above 89 m depth.

In general the materials in borehole PHB-RG-11-CM above 331 m were relatively sound with high recovery percentages, except for the zones where the degree of fracturing is higher, as can be seen by comparing the figures for RQD and the number of fractures shown below. Below 331 m a basic, intrusive body is encountered, with little fracturing and fairly high percentages of RQD.

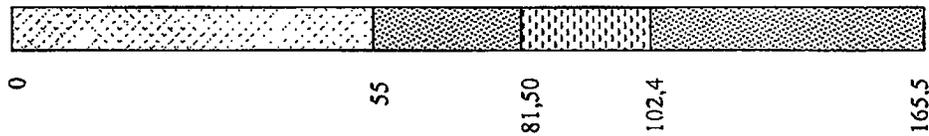
The phreatic level above 331 m was fairly stable, varying between 40 m and 73 m in depth. On reaching the intrusive body some variability was observed, as shown in the graph

illustrating the phreatic levels, with measurements between 150 m and 300 m. However, upon grouting the level tended to stabilize, leading to the conjecture that the intrusive body is impermeable and acts as a barrier, and that once the seal is broken during the drilling process the water tends to leak out. This possibility has not been verified, through the placing of piezometers to continue monitoring the phreatic levels.

The foregoing information may be used by the Contractor, but the Contractor will assume full responsibility for whatever use or interpretation it makes of the data. Detailed results of the prior studies will be made available to prospective bidders by ICE, without warranty of any kind by ICE as to accuracy or completeness.

ANNEX 9

ESQUEMA PERFORACIÓN PHB-RG-09-CM



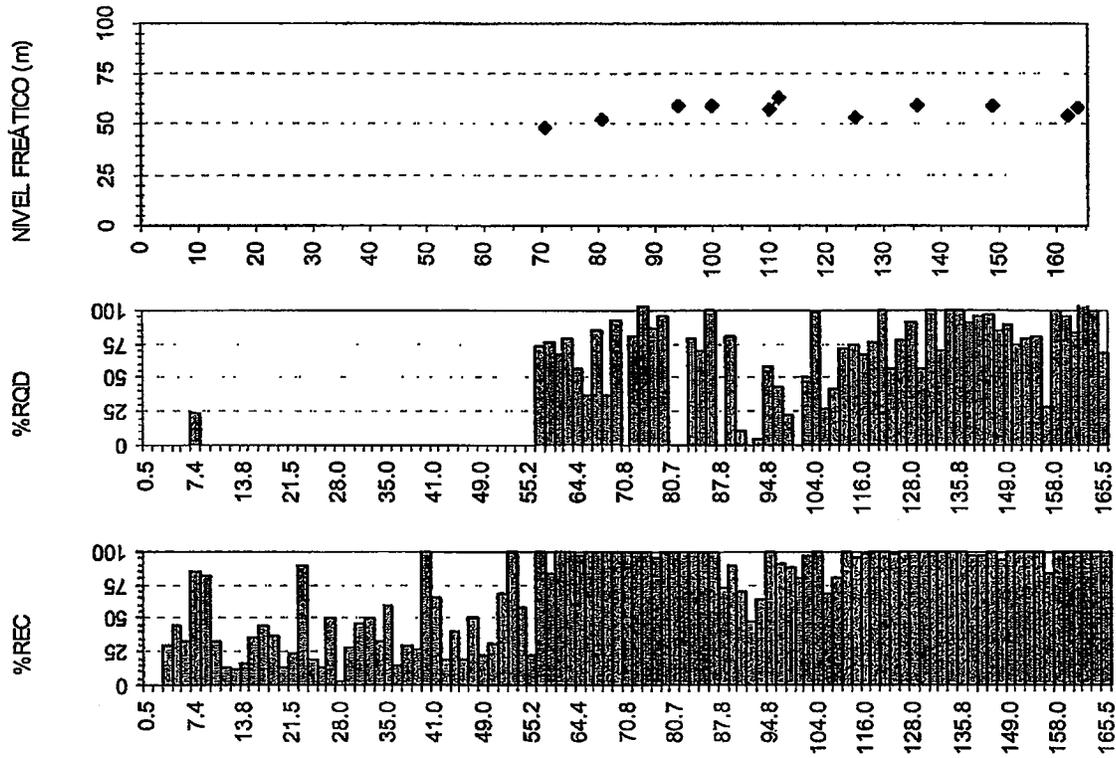
0,00 a 55,50 m
 Material sedimentario, areniscas y lutitas muy fragmentadas, muy posiblemente pertenece al material residual de una zona de un antiguo deslizamiento. Por lo general presentan bajas recuperaciones y bajos RQD

55,50 a 81,50
 Areniscas de grano medio a fino intercaladas con lutitas, generalmente de color gris claro en superficie sana, se presentan bastante sanas y poco fracturadas. El único juego de diaclasas que se observa con claridad corresponde con la estratificación. El tipo de contacto en techo no se puede observar. Como roca intacta aún presenta una resistencia considerable dado que es necesario al menos un golpe de la piqueta para quebrarla.

Entre los 80,70 y los 81,50 se observa una Brecha de color grisáceo y grano fino que se presenta bastante sano pero muy fracturado, compuesto por clastos de origen sedimentario (60-70%) con soporte por matriz. Los bloques van de redondeados a subredondeados. Estratificación de 45 a 60°. Se presentan pocas vetillas rellenas de calcita.

81,50 a 102,40m
 Lutitas de color gris claro a negro con laminaciones e interestratificaciones de areniscas. Se presenta una alteración entre los contactos produciendo que las lutitas se muestren friables. Se presenta un alto contenido de arcilla entre los contactos y una serie de espejos de fricción en los tramos más alterados. Estratificación fina.

102,40 a 165,50
 Intercalaciones de brechas areniscas y lutitas, presentandose bastante sanos y poco fracturados, de colores grisáceos a negros. Los clastos de la brecha son de origen sedimentario (50-60%), y se encuentran en unos disposición caótica flotando en una matriz fina. Las Areniscas de grano medio a fino intercaladas con lutitas, generalmente de color gris claro en superficie sana, se presentan bastante sanas y poco fracturadas



ESQUEMA PERFORACIÓN PHB-RG-11-CM

Descripción litológica

89,00 a 108,60

Lutitas de color gris claro a negro con laminaciones e interestratificaciones de areniscas. Se presenta una alteración entre los contactos produciendo que las lutitas se muestren friables. Se presenta un alto contenido de arcilla entre los contactos y una serie de espejos de fricción en los tramos más alterados. Estratificación fina

108,60 a 265,00

Areniscas de grano medio a fino intercaladas con lutitas y brechas, generalmente de color gris claro en superficie sana, se presentan bastante sanas y poco fracturadas. Las lutitas son de color gris claro hasta negro y por lo general con estratificación fina. Los clastos de la brecha son de origen sedimentarios (50-60%), y se encuentran en una disposición caótica flotando en una matriz fina. Se presenta en colores grisáceos

El juego de diadas que se observa con mayor claridad corresponde con la estratificación. El tipo de contacto en techo no se puede observar. Como roca intacta aún presenta una resistencia considerable dado que es necesario al menos un golpe de la piqueta para quebrarla.

En general se presentan dos juegos de fracturas uno correspondiente a la estratificación con planos ondulados, presentandose algunos espejos de fricción. El otro juego se presenta en vertical.

Estratificación de 45 a 60°. Las fracturas se presentan rellenas de calcita

265,00-316,70

Se presentan areniscas gruesas intercaladas con areniscas medias y finas, presentando un bandeamiento que no se observaba en las areniscas de la parte superior. Es una roca de color gris claro hasta blanco muy sana y poco fracturada, presencia de pirita, muy probable que se encuentre cerca del contacto con el intrusivo.

316,70-331,20

Rocas blancuzcas altamente pulverizables por el efecto de la alteración hidrotermal de los materiales.

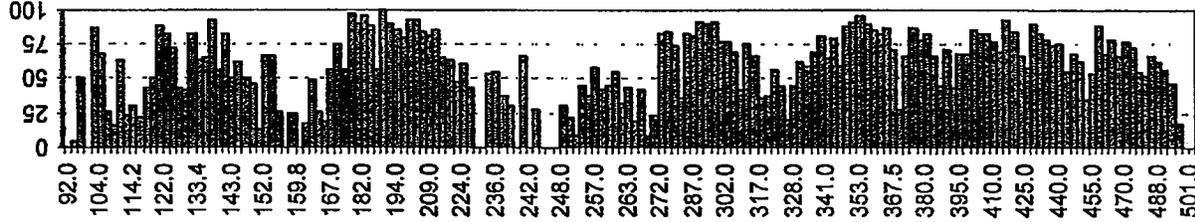
331,20-493,00

Intrusivo de composición básica probablemente un gabro bastante sano y no muy fracturado, con fuertes contenidos de pirita. Hacia la base se comienza a tornar más fino probablemente por un enfriamiento más rápido.

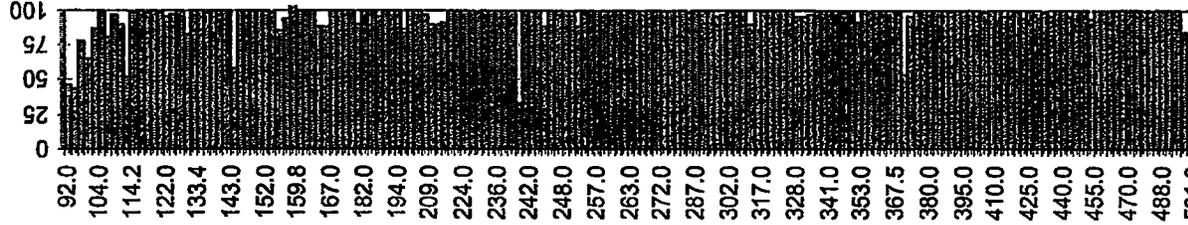
493,00-501,00

Rocas blancuzcas altamente pulverizable por el efecto de la alteración hidrotermal de los materiales, similar al contacto superior de los intrusivos.

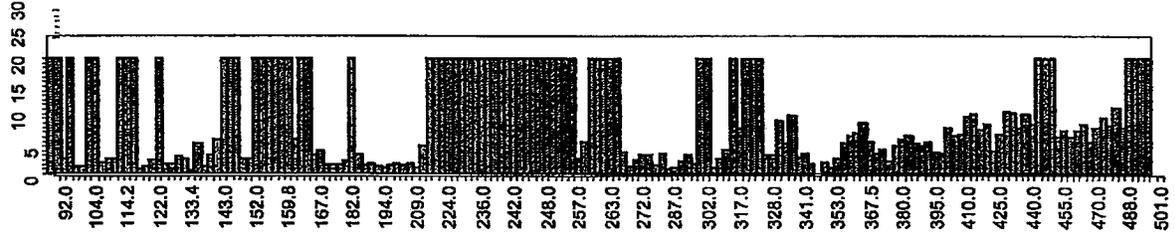
%RQD



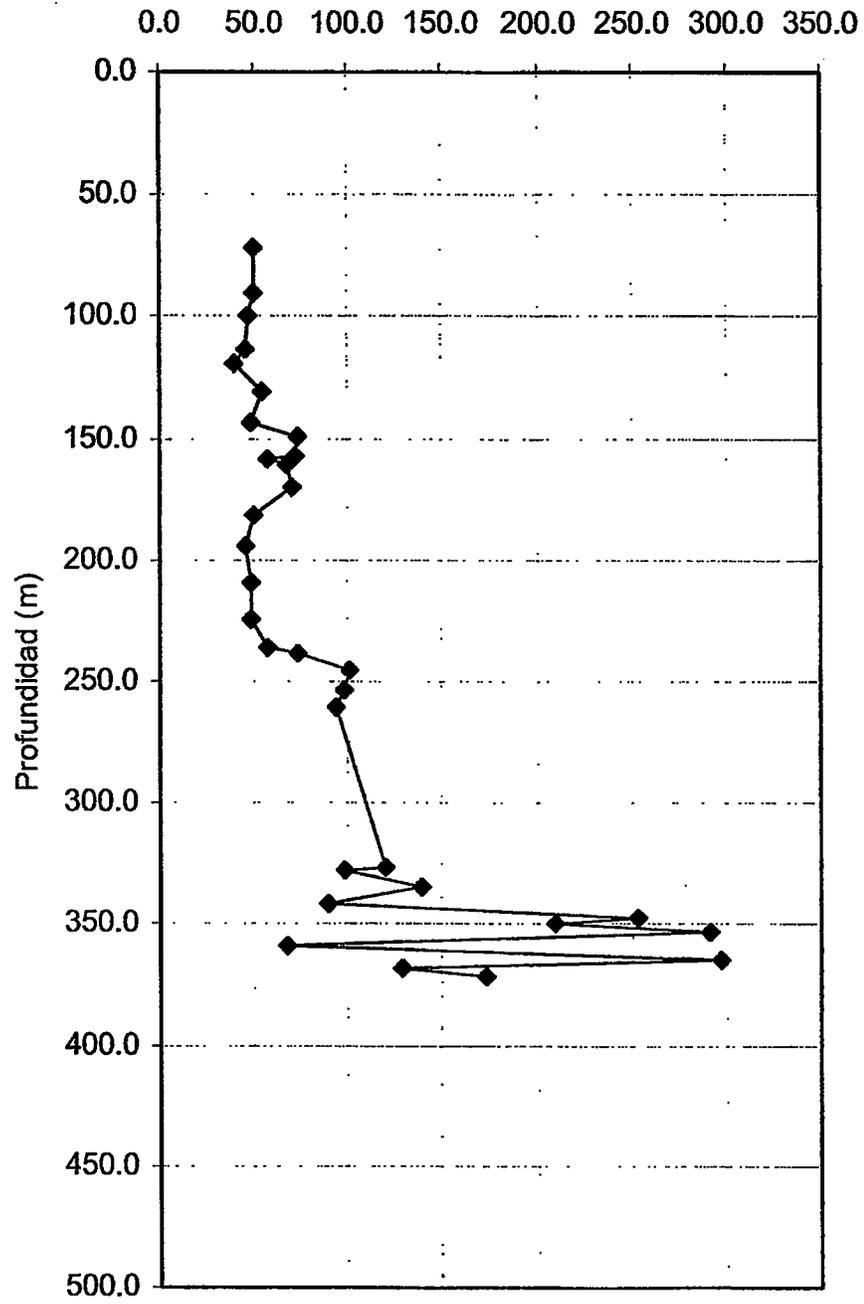
%REC



n° fract/m



Nivel Freático (m)



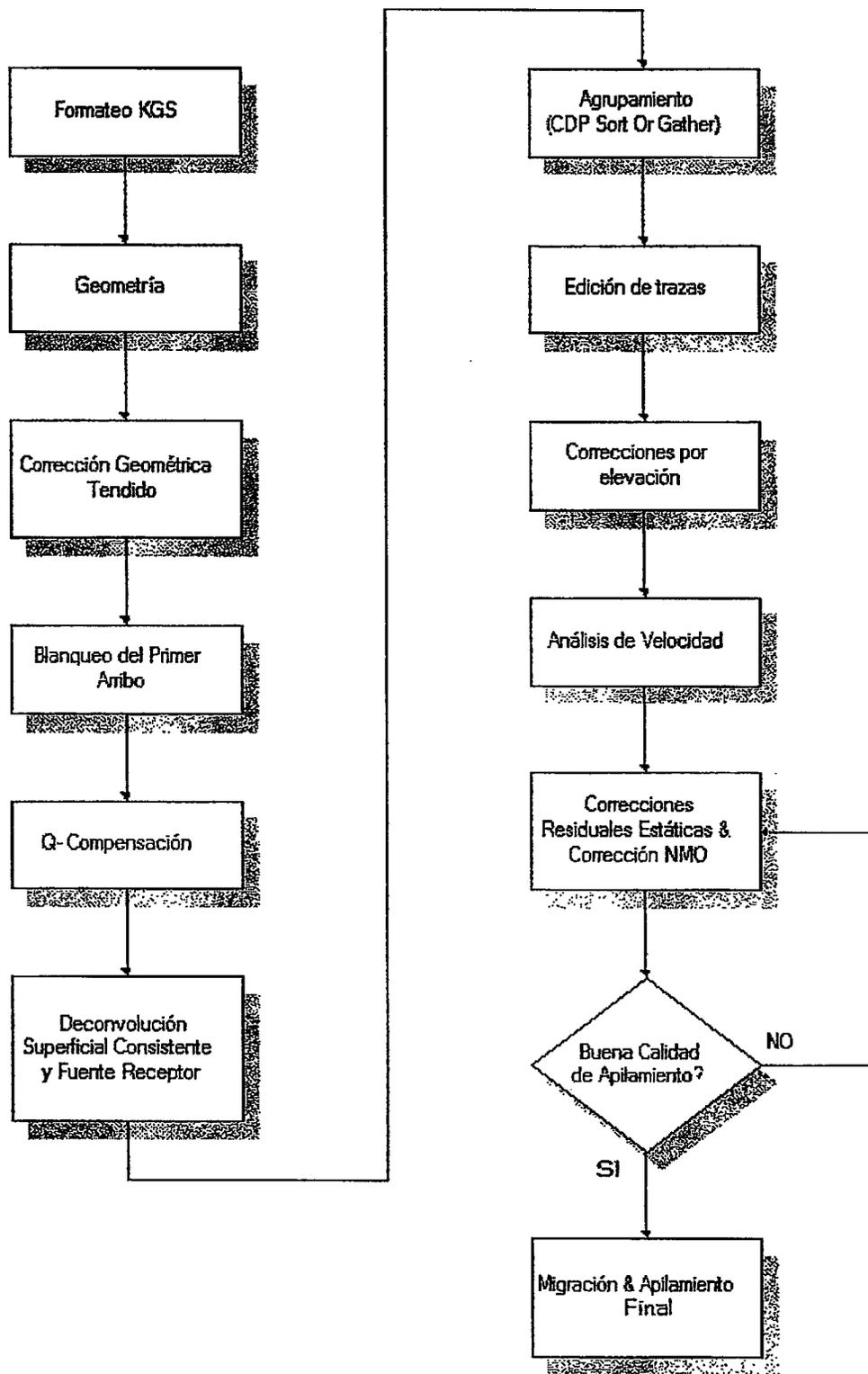
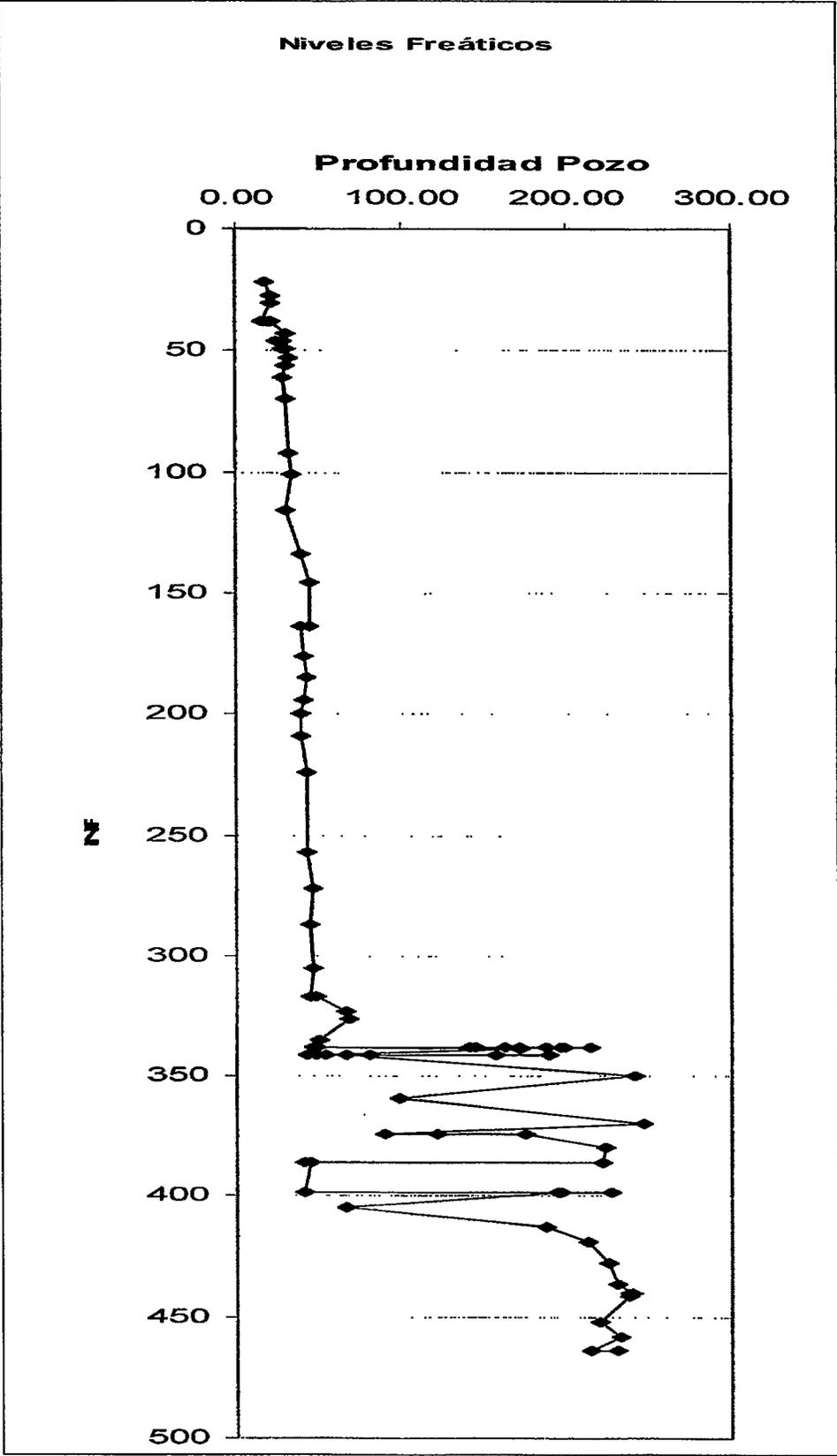
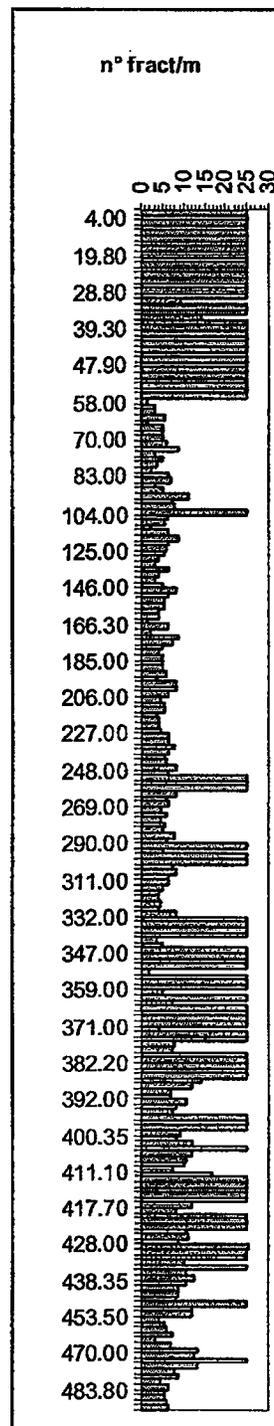
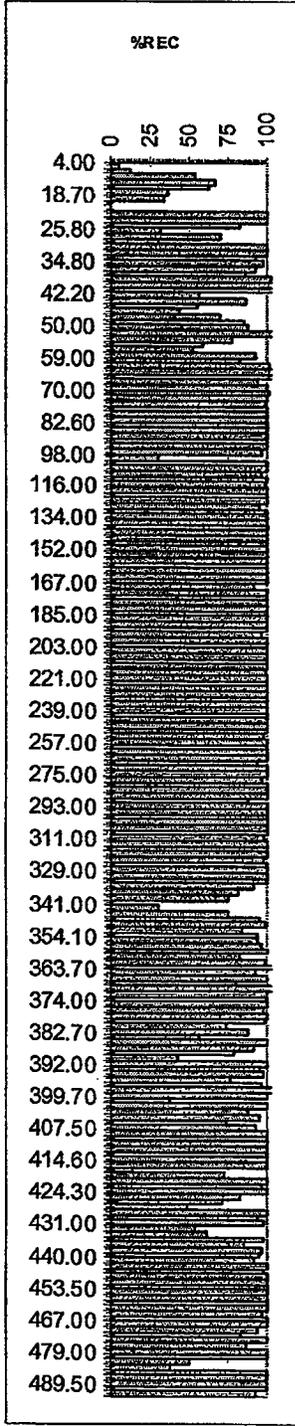
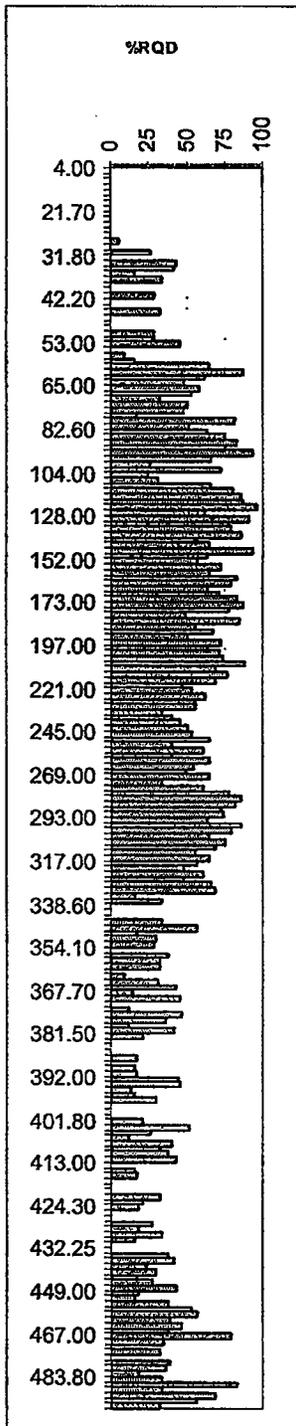


Diagrama de procesamiento de la Información Geofísica

PERFORACIÓN PHB-RG-10-CM



ESQUEMA PERFORACIÓN PHB-RG-10-CM



PFB-RG-010-CM (Elev 459,949m.s.n.m) Coordenadas
326822,862N,521473,251E
Profundidad 490,50m ,Profundidad NF=40m

0-4,00m
Suelo

4-25,80
Material sedimentario altamente fracturado. se encuentran fragmentos tanto de areniscas como de lutitas

25,80-34,80
Areniscas de grano medio a fino intercaladas con lutitas, generalmente de color gris claro en superficie sana, se presentan bastante sanas pero muy fracturadas. El único juego de diaclasas que se observa con claridad corresponde con la estratificación. El tipo de contacto en techo no se puede observar, aunque es probable que se presenten dos juegos de fracturas uno correspondiente a la estratificación con planos ondulados, presentandose algunos espejos de fricción. El otro juego se presenta en vertical con planos ondulado rugosos y espejos de fricción, sin presentar ningún tipo de relleno.
Estratificación de 45 a 60°.

34,80-38
Areniscas de grano medio de color grisáceo bastante sanas. Disminuye el grado de fracturación sin embargo aún es bastante alto. Se pueden observar tres juegos de diaclasas, de lo cuales uno concuerda con el estratificación. En general todos los juegos presentan planos ondulado rugosos sin relleno, muy pocas fracturas presentan rellenos de calcita. En algunos tramos se pueden observar lentes de lutitas

38,00-45,90m
Areniscas de grano medio fino, intercaladas con lutitas, se presentan muy fracturadas y se observan muchos espejos de fricción en las fracturas. es difícil observar la cantidad de juegos de fracturas aunque en general parecen ser tres familias de diaclasas. La roca presentan rellenos de calcita o sin relleno. La roca presenta colores grisáceos y es muy competente.

45,90-95m
Areniscas de grano fino, intercaladas con lutitas, ambas rocas se presentan en color negro grisáceo, la fracturación disminuye considerablemente, y la rocas se presentan bastante sanas, se observan algunos planos de fricción y algunas fracturas presentan rellenos arcillosos, aunque predominan los rellenos de calcita

95,00-104,00m
se presenta el mismo materia pero mucho más fracturado, podría corresponder con una zona de falla, a aunque no se observan espejos de fricción

104,00-119,00m
Areniscas grs muy sanas y poco fracturadas. La granitometría de estas areniscas va desde fina hasta media.

119,00-137,00m
Areniscas de grano fino poco fracturadas presentan laminación paralela y las fracturas se observan rellenos arcillosos y de óxido de hierro. Se presenta en colores gris claro y es posible que coincida con la zona de transición hacia el intrusivo

137,00-140,00m
Areniscas blancuzcas muy pulverizables de grano medio, presentan laminación paralela y altos contenidos de pirita.

140,00-346,50m
Intrusivo de composición básica bastante sano, el cual se presenta bastante fracturado muchos de los tramos. Los últimos metros del intrusivo se vuelve un poco más fino.

346,50-349,10m
Arenisca blancuzca alterada hidrotermalmente, se presenta muy pulverizable, y por lo que se ha visto en la perforación anterior, está coincide con el contacto inferior del intrusivo.

349,10-358,00m
Areniscas de grano fino a medio, muy afectadas por el efecto del intrusivo, presenta laminación paralela y altos contenidos de pirita, se presenta muy fracturadas

358,00-388,20m
Intercalaciones de areniscas grisáceas que van desde areniscas finas a medias con conglomerados finos los clastos del conglomerado son de origen sedimentario y presentan contacto flotante. Las areniscas presentan laminación paralela y se presentan bastante sanas

388,20-396,50m
areniscas finas color gris claro a blancuzca. Se presentan sanas pero bastante fracturadas.

396,50-461,00m
Intercalaciones de lutitas y areniscas de color grisáceo, con alto grado de fracturamiento y con laminación paralela

461,00-469m
Posible brecha calcárea, color blancuzco muy fracturada

137,00-140,00m

Areniscas blancuzcas muy pulverizables de grano medio, presentan laminación paralela y altos contenidos de pirita.

140,00-346,50m

Intrusivo de composición básica bastante sano, el cual se presenta bastante fracturado muchos de los tramos. Los últimos metros del intrusivo se vuelve un poco más fino.

346,50-349,10m

Arenisca blancuzca alterada hidrotermalmente, se presenta muy pulverizable, y por lo que se ha visto en la perforación anterior, está coincide con el contacto inferior del intrusivo.

349,10-358,00m

Areniscas de grano fino a medio, muy afectadas por el efecto del intrusivo, presenta laminación paralela y altos contenidos de pirita. se presenta muy fracturadas.

358,00-388,20m

Intercalaciones de areniscas grisáceas que van desde areniscas finas a medias con conglomerados finos. los clastos del conglomerado son de origen sedimentario y presentan contacto flotante. Las areniscas presentan laminación paralela y se presentan bastante sanas.

388,20-396,50m

areniscas finas color gris claro a blancuzco. Se presentan sanas pero bastante fracturadas

396,50-461,00m

Intercalaciones de lutitas y areniscas de color grisáceo, con alto grado de fracturamiento y con laminación paralela

461,00-469m

Posible brecha calcárea, color blancuzco muy fracturada

469-475,50m

Intercalaciones de areniscas y lutitas, color gris oscuro. presentan laminación paralela y están muy fracturadas

475,50-490,50

Calizas rosadas algáceas. Se puede observar pequeñas intercalaciones de areniscas de un máximo de 20 cm. es posible que en algunos tramos se presenta un brecha calcárea