FIJI ELECTRICITY AUTHORITY

TENDER DOCUMENTS FOR:

WAILOA MID-LIFE REFURBISHMENT CONTROL AND HMI SOFTWARE

CONTRACT NO: MR 286/2017

PREPARED FOR FIJI ELECTRICITY AUTHORITY

October 2017

MWH® now part of Stantec

Fiji Electricity Authority

Wailoa Mid-Life Refurbishment Control and HMI Software

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APPENDICES

1. Project Background

Wailoa Power Station is a four unit station capable of generating 78.3MW. The station was finally commissioned in 1983.

The original relay-logic control panels for automating the generating units are being replaced with a PLC based control system.

This Contract is for the development of PLC programmes and HMI (Human-Machine Interface) applications, supply of HMI server and workstation hardware and software licenses, supply of PLC programming software, in house testing, delivery of hardware to site, commissioning, start up and site acceptance testing of unit controls for four (4) existing turbine-generators.

The software will control and coordinate all of the equipment necessary for a fully automated start up and shutdown of the generating units from a remote location. It will also include the station Common control system and the Intake control system. The software shall interface with the Employer's remote SCADA and protection system.

A separate contract will be awarded for the supply of the control and protection panels and PLC hardware into which the software under this contract shall be loaded. The HMI workstations shall connect to the PLC system via the control LAN, supplied by others.

Other contracts associated with the turbine generators will be proceeding in conjunction with this Contract. The Contractor is required to cooperate with the Employer and other contractors to help facilitate the smooth execution of the work.

The other contracts include:-

- Replacement of the 11kV circuit breakers;
- Refurbishment of the four existing generators.
- Refurbishment of the four existing turbines
- Replacement of the four turbine governors.
- Refurbishment of the turbine inlet valves.
- Replacement of the tail race coolers and upgrade of the cooling water system
- Replacement of the individual Unit control panels;
- Provision of penstock flow monitoring systems
- Numerous small works on the station

A number of other refurbishment projects have already been undertaken at the station including:-

- Replacement of the main 11/132kV step up transformers (completed 2013).
- Replacement of the electronic governors (completed 2012).
- Provision of a single new turbine inlet valve and provision of new hydraulic system to enable refurbishment of the existing valves (contract let 2015);

2. Conditions of Tendering

2.1 Scope of Tender

The Fiji Electricity Authority (FEA) invites Tenders for the development of PLC programmes and HMI applications, supply of HMI server and workstation package, software licenses, in-house testing, delivery of hardware to site, commissioning, start up and site testing of unit controls for four (4) existing turbine-generators for the Wailoa hydro power facility.

The General Conditions of Contract pursuant to which the Contractor will provide the Works are based on FIDIC Conditions of Contract for Plant and Design Build for Electrical and Mechanical Plant and for Building and Engineering Works Designed by the Contractor, First Edition, 1999.

These Instructions comprise these instructions to tenderers together with all documents issued to tenderers in respect of the Works.

These Instructions do not constitute an offer, but are merely an invitation to the tenderer to submit a Tender.

All documents supplied by FEA remain the property of FEA. FEA reserves the right to request the immediate return of all documents supplied and any copies made of them at any time.

2.2 Delivery of Tenders

Tenders shall be submitted to the **TENDER LINK** Electronic Tender Box https://www.tenderlink.com/fea no later than **4:00pm, on Wednesday 29th November, 2017.**

In addition hard copies of the tender, one original and one copy, must be deposited in the tender box located at the FEA Head Office, 2 Marlow Street, Suva, Fiji no later than 4:00pm, on Monday, 20 November, 2017. Addressed as":

Tender – MR 286/2017 – Wailoa Mid-Life Refurbishment Control and HMI Software

The Secretary Tender Committee

Fiji Electricity Authority

Head Office

Suva

Fiji

Evidence must be included demonstrating that the hard copy was dispatched from the Tenderers premises prior to the Tenderlink closing date and time.

For further information contact The Secretary Tender Committee, by e-mail TDelairewa@fea.com.fj

2.3 Tender Validity

All Tenders shall remain open and valid for acceptance for a period of 60 days after the Tender Closing Time.

A Tender, once submitted, may only be varied by the tenderer with the prior written consent of FEA.

2.4 Identification of Tenders

Tender documents are to be delivered packaged and clearly identified.

2.5 Form of Letter of Tender

The form of Letter of Tender shall be as set out in Schedule 1, Tender Form 1.

2.6 Tender Documents

The tender documents comprise the following:

a) Section 1 – Background to the Contract

b) Section 2 – Tender Conditions

c) Section 3 - General Conditions of Contract

d) Section 4 - Particular Conditions of Contract

e) Sections 5, 6, 7, 8, 9, 10, 11 – Specification

f) Tender Schedules

2.7 Information Required with Tender

Tenders shall include the name of the tenderer and a complete postal address for service of notices. Tenders shall include the following minimum information for evaluation:

- A fixed, lump sum tender price for offshore work. Also, a fixed, lump sum tender price for onshore work, for the number of days specified per Section. All prices must be quoted in a single currency, nominated by the contractor plus Fijian dollars if required. The prices shall be excluding Fiji VAT and Withholding Tax and shall be deemed to include all direct, indirect and ancillary charges and costs for the Works. If additional onshore work is required and agreed by the Employer, this shall be invoiced as Time and Materials, according to the rates presented in the response to this tender;
- Statement of compliance with all Tender and Contract requirements.
- Completed tender forms;
- Full details of the HMI hardware and software licenses proposed;
- Proposed programme for design, development, testing and delivery;
- Proposed key personnel;
- Any supplementary information required by the documents issued to the tenderers;
- Any interpretation or other statements by the tenderer affecting the Tender;
- The Tender shall be signed by or on behalf of the tenderer by a person with the delegated authority to do so. Written proof of the delegated authority to sign the tender offer may be requested.

2.8 Site Visit

A site visit is not considered necessary for this Tender. However, should any tender wish to arrange a visit they shall advise the Engineer within two weeks of the date of the Employer issuing the tender documents. The Employer will then endeavour to arrange a single visit a time that best suits the Employer, Engineer and all other bidders.

2.9 Evaluation of Tenders

Tenders received will be evaluated on the basis of such matters as FEA in its sole discretion determines are relevant, which may include the following:

- Quality of the solutions and plant offered and completeness of the offer.
- Tender sum and quoted rates and on-costs for possible approved variations.
- Proposed programme for the implementation and completion of the Works.
- Tenderer's experience, capability and commitment to achieving the project objectives.
- Tenderer's health and safety performance record and commitment.
- Compliance with the Contract conditions and specifications.

FEA may apply whatever weighting it considers in its sole discretion to be appropriate and the order set out above is not and shall not be taken to be the order of priority of the factors being considered by FEA.

2.10 Acceptance of Tender

FEA may, in its absolute discretion:

- Decline to consider any Tender;
- Reject all Tenders;
- Accept any Tender, notwithstanding that any other tender may propose a lower cost method of achieving FEA's objectives;
- Accept any Tender, even though it may not be in accordance with these Instructions.

FEA reserves the right to enter into negotiations with any unsuccessful tenderer or other party after the Tender Closing Time to complete the Contract.

2.11 Advice on Tender Outcome

All tenderers who submit a complying Tender will be notified of the outcome of the Tender. The advice will be limited to the name of the successful tenderer only if a Tender is accepted.

The successful tenderer will be invited by FEA to execute the Contract Agreement.

The original copies of all Tenders delivered to FEA will be the property of FEA and will not be returned to tenderers (unless FEA determines otherwise, in its absolute discretion).

2.12 Tender Enquiries

All enquiries relating to these Instructions shall be addressed to:

Tuvitu Delairewa
Fiji Electricity Authority
Phone: +679 999 2436
Email: TDelairewa@fea.com.fj

Any additional information, modifications or clarifications arising from enquiries from any tenderer will be confirmed in writing to all tenderers unless non-disclosure is necessary to protect tenderer confidentiality.

2.13 Communication

All communications regarding these Instructions may only be made to Tuvitu Delairewa. FEA will not be bound by any statement, written or verbal made by any person other than Tuvitu Delairewa, who is the only person authorised to make representations or explanations regarding these Instructions.

FEA may issue clarifications or changes to these Instructions by way of written Notice to Tenderers ("NTT") at any time prior to the Tender Closing Date. A copy of each NTT will be mailed or delivered to those who have received a copy of these Instructions. All NTTs issued will become part of this tender.

Where the Instructions are ambiguous or unclear to a tenderer, the tenderer may request the issue of an NTT for clarification. All such requests should be made in writing to Tuvitu Delairewa. A copy of each NTT issued will be mailed or delivered to those who have received a copy of these Instructions. All NTTs issued will become part of these Instructions.

In the absence of an NTT, Tenders may be submitted subject to any reasonable interpretation of any ambiguity or uncertainty in these Instructions, which shall be endorsed on the Tender.

2.14 Submission of Tenders

It is FEA's preference to contract on the basis set out in these Instructions. However, FEA may consider alternative Tenders. Any alternative Tender should clearly identify the commercial advantage and 'value added' offered.

By submitting a Tender, the tenderer confirms that FEA is authorised to:

- Verify with any third party any information included in the Tender or disclosed to FEA in connection with the tender;
- Discuss any matter relating to the tenderer or the tenderer's performance with any referee or other third party;

- Carry out a credit check on the tenderer and any proposed guarantor or other security provider.

The cost of preparing and submitting a Tender shall be borne by the tenderer

2.15 Tender Conditions

FEA reserves the right to:

- Suspend or cancel (in whole or in part) this tender process and/or overall process without assigning a reason;
- Terminate or exclude at any time participation by any tenderer in the tender process without assigning a reason;
- Call and/or re-advertise for tenders or revisit any tender process;
- Waive any irregularities or informalities in this tender process;
- Run the tender process as it sees fit, including by varying the process without assigning reason;
- Select suppliers based on their tender responses and/or invite them to participate in a further closed or open tender process;
- Issue Instructions with modified descriptions of goods/services requirements, including innovations identified and/or proposed FEA through this tender process;
- Enter into discussions and/or negotiations with one or more tenderers relating to matters dealt with in these Instructions;
- Deal separately with any of the divisible elements of any tender response, unless the relevant tender response specifically states that those elements must be taken collectively;
- Limit or extend the list of potential tenderers beyond those who respond to these Instructions;
- Seek clarification of any aspect or information provided in any tender response, and seek further information from any party;
- Consider, accept or reject any further Tenders (including any alternative or non-conforming Tenders) it may receive from any tenderer or other correspondent;
- Change any time, date or timeframe in, or any other aspect of, this tender process (including extending the closing date for the receipt of tender responses) by notice in writing to each tenderer;
- Liaise or treat with any prospective or actual tenderer at any time without necessarily liaising or treating with any other prospective or actual tenderer;
- Delete or change its requirements for any goods/services covered by this tender process;
- Conduct a financial check on any tenderer submitting a tender response; and
- Obtain similar goods/services from any third party and not deal exclusively with any tenderer under this tender process.

FEA will not be bound to give any reasons for decisions made as a result of the tender process or as an outcome of the Tender evaluations. Nothing contained or implied in these Instructions shall oblige FEA to discuss, justify or give reasons for any of its decisions or actions relating to these Instructions or any response.

Whilst FEA seeks to ensure that the supporting information contained in these Instructions and otherwise provided by or on behalf of FEA to the tenderer is accurate:

- FEA makes no representation or warranty, whether express or implied, as to the completeness, correctness or accuracy of such information; and
- Any drawings, reports or other material provided by or on behalf of FEA are provided for information purposes only and may not be relied upon as constituting accurate information.
- The tenderer is to make its own enquiries as it considers necessary before relying on any information provided by FEA and before submitting its Tender. FEA shall have no liability for any inaccuracies, errors, omissions or mistakes in such documentation.

Those submitting tender responses will be deemed to have:

- Examined these Instructions and all documents referenced (if any);
- Considered all the risks, contingencies and other circumstances that may have an effect on their tender responses;
- The Tenderer will be deemed to have visited the site and satisfied themselves that the offer is complete. On site conditions will not be accepted as a reason for variation at a later date.
- Taken into account all restrictions, procedures, costs, timings and potential difficulties which may affect the performance of the Works; and
- Satisfied themselves as to the correctness and sufficiency of their tender responses, including the pricing structure offered.

All tenderers submitting a Tender agree that:

- A contract is only formed between FEA and the successful tenderer when FEA executes the Contract Agreement, setting out in full the terms upon which FEA has engaged that tenderer to carry out the Works;
- These Instructions, and any provision contained herein, do not give rise to a separate contract between FEA and the tenderer; and
- Nothing in these Instructions, or in the relationship of FEA and the tenderer, imposes any duty of care on FEA, and any such duty of care is expressly excluded.
- All costs incurred by the tenderer in connection with its Tender, these Instructions or any related matters are the sole responsibility of the tenderer.

2.16 Tender Responses

Each tenderer must include the information as required by FEA in these Instructions. Information not specifically required by these Instructions, but believed by the tenderer to be of value in evaluating the responses, should be included as an addendum. Where there is reference to published manuals, only the relevant extracts should be placed in the addendum.

All tenderers warrant that:

- All information provided in their response is complete and accurate in all material respects;
- Provision of information to FEA, and the use of it by its employees, agents or contractors for the evaluation of responses and the possible subsequent negotiation and implementation of a contract, will not breach any third party's intellectual property rights; and
- FEA is under no obligation to check any tender response for errors. Acceptance of a tender response that contains errors will not invalidate any contract that may be negotiated on the basis of that tender response.
- Tenderers must not, without FEA's prior written consent, consult, communicate or agree with any other tenderer in connection with any Tender, and shall not make any attempt to influence any other tenderer to submit or not submit a Tender or to alter the proposed content of that tenderer's Tender.

2.17 Confidentiality

These Instructions, all information supplied by FEA (either itself or through its consultants or advisors) in connection with these Instructions and all discussions relating to these Instructions, are confidential. Tenderers must not release or disclose any of the information or discussions to any other person (other than the tenderer's employees or advisors on a need to know basis) without the prior written consent of FEA.

All drawings and documents of the existing works included in these tender documents are provided for the sole purpose of enabling Tenders to submit to the Employer proposals to rehabilitate the works. Unsuccessful Tenderers shall destroy all such drawings and documents following notification of award to another party. Any use of the drawings and documents by a Tenderer, other than for the purposes of assisting the Employer in rehabilitating the works, may breach the original manufacturer's copyright and the Tenderers shall indemnify the Employer and Engineer against the costs of any claim or defending any such claims that may arise from such breach of copyright by the Tenderer.

2.18 Preferred Tenderer

Should a tenderer be informed that they are a preferred tenderer, such advice does not:

- Constitute an acceptance by FEA nor create a contract;
- Constitute an award of the contract; nor
- Imply or create an obligation on FEA to enter into negotiations with or award the contract to the tenderer.

FEA reserves the right to discontinue negotiations at any time.

2.19 Acknowledgement by Tenderer

Each tenderer acknowledges that FEA has reserved to itself certain rights and discretions in these Instructions and agrees that it assumes, at its sole cost, the risk that FEA may at any time exercise any of these rights and discretions. Each tenderer agrees that it shall not have any rights, and further waives any rights it may have, against FEA or any other person arising from the exercise by FEA of its rights and discretions, and agrees not to make any claim, bring any action or otherwise seek to recover from FEA any costs incurred by that tenderer in respect of its Tender or any lost expectation of profits or other benefits which that tenderer may expect to accrue to it from acceptance of its Tender.

2.20 Governing Law

These Instructions shall be construed according to and governed by Republic of the Fiji Islands Law and the tenderers agree to submit to the non-exclusive jurisdiction of the Fijian Courts in any dispute or difference of any kind which may arise concerning the same.

3. General Conditions of Contract

3.1 Appendix to Tender

The General Conditions of Contract pursuant to which the Contractor shall provide the Works will be the "FIDIC - Conditions of Contract for Plant and Design-Build for Electrical and Mechanical Plant, and for Building and Engineering Works, Designed by the Contractor", First Edition, 1999.

All capitalised terms in this section of the documents are as defined in The General Conditions of Contract unless the context requires otherwise or unless amended by the Particular Conditions of Contract.

References to Sub Clauses in this section are references to Sub Clauses in the General Conditions of Contract.

The Employer: Sub Clause 1.1.2.2

The Employer is:	Fiji Electricity Authority
	Private Mail Bag
	2 Marlow St
	Suva
	FIJI ISLANDS
The Employer's Representative is:	Eparama Tawake
	General Manager - Generation

The Contractor: Sub Clause 1.1.2.3

The Contractor is:

Telephone:

Facsimile:

Email:

The Engineer: Sub Clause 1.1.2.4

The Engineer is:	Robin Spittle	
	Stantec New Zealand	
	PO Box 4	
	265 Princes St	
	Dunedin	
	NEW ZEALAND	
	Telephone:	+64 021 649402
	Facsimile:	+64 4 477 0616
	Email:	robin.spittle@stantec.com

The Engineer's Representative: Sub Clause 3.2

The Engineer's Representative is:	Tim Lusk	
	Stantec New Zealand	
	PO Box 4	
	265 Princes St	
	Dunedin	
	NEW ZEALAND	
	Telephone:	+64 27 455 0139
	Facsimile:	+64 4 477 0616

Email: timothy.lusk@stantec.com

Time for Completion: Sub Clause 1.1.3.3

Section 1: 212 days

Section 2: 304 days

Section 3: 414 days

Section 4: 487 days

Section 5: 557 days

Defects Notification Period: Sub Clause 1.1.3.7

365 Days for each of Sections 1, 2, 3, 4 and 5 of the Contract.

Contract Sections: Sub Clause 1.1.5.6

Offshore Part

Section 1: Development of PLC programmes and HMI application, supply of HMI server and workstation hardware, supply of HMI and PLC software licenses, in-house testing of the complete package and delivery to site.

Onshore Part

There are four separate Sections

Section 2: Commissioning, start up and site acceptance testing of Unit 4 control system, installation and commissioning the station HMI system, provision of training.

Section 3: Commissioning, start up and site acceptance testing of Unit 3 control system.

Section 4: Commissioning, start up and site acceptance testing of Unit 2 control system.

Section 5: Commissioning, start up and site acceptance testing of Unit 1 control system, Common Services control system and Intake control system.

Each Separate Section shall be a standalone Section of the contract with its own Taking Over, Certificate of Acceptance, Defects Liability Period and Performance Certificate.

The following applies

a) The Employer reserves the right to change the order in which each generator is refurbished.

b) Only one turbine generator unit can be out of service at any time.

Electronic Transmissions: Sub Clause 1.3

Electronic transmissions shall be by email. Drawings shall be transmitted as AutoCAD drawing files and PDF files. Spreadsheets shall be transmitted as Microsoft Excel files or PDF files. Typed documents shall be transmitted as Microsoft Word files or PDF files. The PDF files shall be created using Adobe software.

Governing Law: Sub Clause 1.4

The Contract shall be governed and take effect in accordance with the laws of the Republic of Fiji and any arbitration shall be governed by such laws. The parties hereto submit to the non-exclusive jurisdiction of the Fiji Courts.

Ruling Language: Sub Clause 1.4

English

Language for Communications: Sub Clause 1.4

The language for all communications is English.

Time for Access to the Site: Sub Clause 2.1

The Employer shall give the Contractor right of access to, and non-exclusive possession of, each part of the Site on or before the possession dates shown in the latest approved programme. Refer to clause 3.3 of Preliminary and General Section of this Contract for the preliminary programme.

Engineer's Duties and Authority Sub Clause 3.1

The Engineer must obtain approval from the Employer for any Variation that increases the Contract Price.

Performance Security Sub Clause 4.2

10% of the Accepted Contract Amount for all Sections of the Contract up to Taking Over of the final Unit Control Software covered under the contract. This shall reduce to 5% during the Defects Notification Period for the final Unit Control Software.

Employer's Equipment: Sub Clause 4.20

None to be provided..

Period for Notifying Unforeseeable Errors, Faults and Defects in the Specification: Sub Clause 5.1

14 days after Commencement Date.

Working Hours Sub Clause 6.5

Working hours shall be between 7am and 10pm unless otherwise approved by the Employer.

Commencement of Work Sub Clause 8.1

The Commencement dates for each all Sections of the works is the date of the Letter of Acceptance.

Delay Damages Sub Clause 8.7

Offshore Part

a) 0.5% of the Value of the Offshore Part per day, up to a maximum of 10% of the Offshore Part value.

Onshore Part

a) 0.5% of the Value of each Section of the Onshore Part per day, up to a maximum of 10% of the Onshore Part value, plus;

b) If the delay to one Section causes a second Section to be delayed, only the delay damage for a single Section will be applied unless other matters delay the second or subsequent Section

Adjustments for Changes in Cost Sub Clause 13.8

The Contractor shall propose a method for adjusting for any changes in cost over the time the Works under the Contract are being carried out. The agreed method for adjusting the cost during the duration of the Contract will be set out in the Letter of Acceptance. No cost increase will be allowed for delays in completion of any of the Sections of Work or for the effect of a delay in one Section of the Work on subsequent Sections of Work.

Percentage of Retentions: Sub Clause 14.3

There will be no retentions.

Delayed Payment: Sub Clause 14.8

The interest rate for delayed payment shall be at the Westpac Banking Corporation of Fiji base commercial overdraft rate applicable at the time of the delayed payment plus 1.8% per annum.

Currencies of Payment: Sub Clause 14.15

Payments can be claimed in Fiji dollars plus a single nominated currency. Australian, New Zealand, Euro and US currency are permitted. Other international currencies will be considered. The maximum amount owing in each currency must be nominated at time of tender

The rate of exchange between currencies shall be the sell rate quoted by the Westpac Banking Corporation of Fiji at the Base Date.

Period for Submission of Insurance: Sub Clause 18.1

(a) evidence of insurance: within 28 days of the acceptance of contract.

(b) relevant policies: Within 28 days of the acceptance of contract.

Maximum Amount of Deductibles For Insurance of Employer's Risks: Sub Clause 18.2(d)

US$50,000

Minimum Amount of Public Liability Insurance: Sub Clause 18.3

US$10,000,000

Minimum Amount of Professional Indemnity Insurance: Sub Clause 18.5

Value of the Works plus 20%

Motor Vehicle Third Party Insurance: Sub Clause 18.6

US$1,000,000

The DAB shall be: Sub Clauses 20.2

There is no DAB. Refer to the Particular Conditions Clauses 20.2 to 20.4

4. Particular Conditions of Contract

The following Particular Conditions of Contract amend or modify or are in addition to the General Conditions of Contract.

4.1 Definitions

References to Sub Clauses in this section are references to Sub Clauses in the General Conditions of Contract.

1.1.1.1	*second line, replace* "Employer's Requirements" *with* "Specification".
1.1.1.5	*delete and substitute:* "Employer's Requirements" means the purpose, scope, design requirements and technical data contained in the Specification.
1.1.2.2	*delete and substitute: "Employer" means Fiji Electricity Authority, its assignees and any legal successors in title to Fiji Electricity Authority.*
1.1.2.8	*delete and substitute: "Engineer" means Stantec New Zealand, its assignees and any legal successors in title to Stantec New Zealand.*
	add "and includes a Nominated Subcontractor" after "Works" on line 3
1.1.3.3	*delete. There is no Dispute Adjudication Board*
Add new Sub Clause:	
1.1.3.10	"Acceptance Certificate" means the certificate to be issued by the Engineer to the Contractor pursuant to clause 12.5."
Add new Sub Clauses:	
1.1.6.10	"Specification" means Sections 5, 6, 7, and 8 of the Contract and the Common Requirements Section provided in Appendix B of the Contract.

4.2 Changes and Additions to the General Conditions of Contract

References to Sub Clauses in this section are references to Sub Clauses in the General Conditions of Contract.

1 The Contract

1.5 Priority of Documents

Delete and substitute:

The documents forming the Contract shall be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of documents from highest to lowest shall be in accordance with the following sequence:

(a) Contract Agreement;

(b) Letter of Acceptance;

(d) Appendix to Tender;

(e) Completed Tender Schedules;

(f) Notice to Tenderers (NTT);

(g) Particular Conditions;

(h) General Conditions;

(i) Specification;

(j) Letter of Tender;

(k) Contractor's Proposal;

(l) Instructions to Tenderers.

1.7 Assignment

Delete and substitute:

"The Contractor shall not assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, the Contractor may:

(a) Assign the whole or any part of the Contract with the prior agreement of the Employer, at the sole discretion of the Employer, and

(b) As security in favour of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.

The Employer shall be free to assign the whole or any part of the Contract or any benefit or interest in or under the Contract."

1.8 Care and Supply of Documents

First paragraph, replace "six" *with* "three".

Second paragraph, replace "Employer's Requirements" *with* "Specification".

1.12 Confidential Details

Add the following:

"The Contractor shall treat the details of the Contract and the Works as private and confidential except to the extent necessary to carry out obligations under the Contract or to comply with applicable Laws. The Contractor shall not publish, permit to be published or disclose any particulars of the Works in any trade or technical paper or elsewhere without the prior agreement of the Employer."

"The Contractor is required to disclose to the Engineer or the Employer confidential information to allow:

(a) The Plant and the Works to be fully integrated with existing systems and operated and maintained in the correct manner; and

(b) The Employer or the Engineer to confirm the full compliance with the Specification.

2 The Employer

2.1 Right of Access to the Site

Insert the words "Subject to Sub-Clause 4.15 (Access Route)" *at the beginning of the first paragraph.*

3 The Engineer

4 The Contractor

4.1 Contractor's General Obligations

In line 4 of the last paragraph delete the words "to the Engineer" *and insert* "and approved by the Engineer. No refusal by the Engineer to such alterations shall give rise to a claim for a Variation, extension of time, cost or profit."

Add the following at the end of the Sub Clause:

The Contractor agrees that if at any time during the performance of the Works the Contractor is of the opinion that a change in the design or execution of the Works:

(a) is necessary to eliminate a potential defect in the Works or a specific hazard to any person in the performance or operation of the Works; or

(b) would otherwise be beneficial to the Employer (whether by maximising the efficiency or cost effectiveness of the construction, operation and maintenance of the Works or otherwise);

then the Contractor shall bring the matter to the attention of the Engineer in writing and the Engineer shall determine whether Clause 13 [Variations and Adjustments] shall be applied and shall notify the Contractor accordingly.

4.2 Performance Security

Delete the first paragraph and substitute:

The Contractor shall provide the Employer with Performance Security in the form of an unconditional on demand bond to secure performance of the Contractor's obligations under the Contract Agreement. The Performance Security shall be for the amount stated in the Appendix to Tender. The Performance Security shall be provided as an irrevocable bond provided by a surety which shall be a registered bank in Fiji, New Zealand or Australia or such other jurisdiction as approved by the Employer.

Add the following to the end of the Sub Clause:

If the Performance Security is not delivered to the Employer within the required time or at any time ceases to be valid and enforceable (except in the circumstances expressly permitted in the contract), or the surety providing the Performance Security becomes, in the reasonable opinion of the Employer, no longer acceptable credit support then the Employer shall be entitled to:

(a) suspend the contract until the Performance Security (or an acceptable replacement, as the case may be) is delivered to the Employer. Such suspension shall not be treated as a Variation and the Contractor shall not be entitled to any extensions of time or any compensation as a result of such suspension;

(b) withhold any payments due to the Contractor until the Performance Security (or an acceptable replacement, as the case may be) is delivered to the Employer. The Contractor shall not be entitled to make any claims against the Employer by reason of any such withholding of payments; and/or

(c) without limiting the foregoing, treat such failure as a default by the Contractor under Sub Clause 15.2.

Following consultation with the Contractor, where the Employer gives reasons for its view, the Employer shall be entitled to require the Performance Security to be replaced by another form of security acceptable to the Employer if it reasonably forms the view at any time that the validity or enforceability of the Performance Security or credit-worthiness of the surety providing the

Performance Security may be in question. The Contractor shall, within 14 days after receipt of the Employer's request for the Performance Security to be replaced, procure the replacement Performance Security and deliver the same to the Employer within the 14 day period. The Employer shall release a replaced Performance Security within 14 days of receiving the replacement Performance Security from the Contractor, provided that should there be any unpaid claims on such replaced Performance Security, the Employer shall not be required to release it until such claims have been paid in full.

4.5 Nominated Subcontractors

Add the following as a second paragraph:

"Where such notice of objection is given to the Engineer and the matter is not resolved within a reasonable time the Employer or the Engineer shall make a fresh nomination of a Subcontractor. Alternatively the Engineer and the Contractor may agree to the work being carried out by the Contractor or by another Subcontractor or by some other contractor under a separate contract with the Employer."

4.16 Transport of Goods

Add the following:

"Any packing used shall prevent mechanical damage to the contents. It shall also prevent the ingress of water. Desiccants shall be included in each waterproof package. Each package shall be clearly labelled with its contents, drawing reference, destination, handling requirements and weight.

Packing of any Plant or Materials shipped from overseas shall comply with The Fiji Islands import regulations. The Contractor shall certify, with the notice provided under (a) above that no prohibited materials have been used for packing. The Contractor shall be responsible for any fumigation costs or other costs resulting from packing that does not comply with The Fiji Islands import regulations.

The Contractor shall not bring any Goods onto the Site unless and until the time they are to be incorporated into the Works.

All Goods when incorporated into the Works shall be free from all charges, encumbrances or liens.

4.18 Protection of the Environment

Delete the second paragraph and substitute:

"The Contractor shall ensure that all activities and operations under the Contract comply with all applicable Laws, and all applicable the environmental requirements for the Works"

Add the following at the end of the Sub Clause:

In carrying out the Works, the Contractor shall not do anything or omit to do anything, or use materials, substances or processes which:

(a) might discharge a contaminant into the environment, cause the emission of noise to exceed such levels, or cause any adverse effect on the environment, which would constitute a breach of the environmental approvals applicable to the Works or the Site;

(b) is a breach of any duty or obligation of the Employer; or

© is a breach of any of the environmental approvals applicable to the Works or the Site or causes the Employer to breach any such approvals for Works on the site; or

4.22 Security of the Site

Add to the end of paragraph (a):

"The Contractor shall advise the Engineer if the Contractor is aware of unauthorised persons on the Site."

5 Design

5.1 General Design Obligations

Add at the end of the Sub Clause:

Without limiting the foregoing, the Contractor must ensure that the Plant, Materials and the Works are professionally designed to be appropriate and fit for the purposes for which the Works are intended as defined in the Contract and which meet the technical specifications, design life and the performance requirements set out in the Specifications and the Contractor's Tender.

5.9 Additional Design Issues

Add new Sub Clause 5.9:

"The Contractor agrees to accept all responsibility and meet all costs for developing all aspects of the design required by the Specifications and to produce detailed plans and specifications.

The Specifications include preliminary plans and specifications that describe the scope, requirements and expectations of the Employer in respect of the Works and their operation. The Contractor acknowledges in this regard that:

(a) The Specifications are a guide only and do not cover all items of work required to provide the Works; and

(b) The Employer accepts no responsibility for the completeness or accuracy of the design, plans, drawings and specifications described in the Specifications.

The Contractor shall develop the design described in the Specifications into a concept design and a detailed design (which for the purposes of this Sub Clause 5.9 are the *designs*). The content of the designs shall be as described in the Specifications.

The Contractor shall certify to the Employer that the designs comply with at least the minimum requirements and expectations of the Employer in respect of the undertaking and performance of the Works as described in the Specifications.

The Contractor shall submit the designs to the Engineer for review on the dates specified in the Specifications, and shall undertake any factory or Site testing as required by the Specifications and supply the test results to the Engineer.

Except where the Contract otherwise provides:

(a) The Engineer shall not be required to check the designs for errors, omissions, inconsistencies, ambiguities, discrepancies or compliance with the Contract.

(b) Any acknowledgement, comment, or approval of the designs by the Engineer shall not prejudice or affect the Contractor's obligations to complete the Works in strict compliance with the Contract

(c) If errors, omissions, inconsistencies, inadequacies or other defects are found in the designs, the designs and the Works shall be corrected at the Contractor's cost, notwithstanding any consent or approval given by the Engineer.

5.10 Design Responsibility Scope

Except where the Contract otherwise provides:

(a) The Contractor is responsible for the development of unit control software to reside in the separately supplied Unit PLC system.

(b) The Contractor is also responsible and for developing the software application for the HMI hardware package, to be provided under this Scope.

(c) The Contractor is not responsible for the electrical design, PLC hardware design, or design of communications networks.

5.11 Technical Standards and Regulations

Add New Clause 5.11

Wherever reference is made in the Contract to specific standards and codes to be met by the Materials, Plant, and other Goods to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards that ensure substantial equivalence to the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure substantially equal performance, the Contractor shall comply with the standards specified in the documents.

The Fiji Electricity Regulations Cap 180 Regulations 45, 46 and 47 shall apply to all elements the Works.

6 Staff and Labour

6.5 Working Hours

Add the following:

"The normal working hours in respect of those parts of the Site owned by the Employer are restricted (if at all) to the extent specified in the Appendix to Tender. The Contractor acknowledges that where any part of the Works is to be carried out on parts of the Site not owned by the Employer, the Contractor will be required to comply with any restrictions on working hours put in place by the owner of the Site."

Insert the following at the end of the Sub Clause:

"Any works undertaken pursuant to the above shall not entitle the Contractor to additional costs, unless such work is undertaken pursuant to a Variation."

6.7 Health and Safety

Delete and substitute:

"The Contractor, in its capacity as an employer and a person in control of a place of work, shall ensure that its employees, any other persons in the workplace and people in the vicinity of the workplace, are not harmed by any workplace hazard. The Contractor shall comply with health & safety requirements for Site, the Contractor's health and safety plans and its obligations under the Fiji Health and Safety at Work Act 1996 including subsequent amendments (including all regulations and, where appropriate,

Codes of Practice made under the Act), and the Electricity Regulations and any other legal and statutory safety obligations in relation to ensuring the safety of its employees, hazard management, information for employees and training and supervision of employees, and any other statutory safety obligations.

The Contractor, in its capacity as an Employer and a person in control of a place of work, shall ensure that its employees, Subcontractors, and any other persons on the Site and in the vicinity of the Site for whom it is responsible, are informed of existing Site specific hazards, emergency and other requirements and the Employer's expectations and requirements as regards health and safety, all as set out in the Specification or advised from time to time by the Engineer. The Engineer shall notify the Contractor of all of the Employer's key personnel at the workplace and their contact details for accident and other reporting purposes.

The Contractor shall immediately notify the Engineer in writing of any hazard the Contractor identifies on the Site, the date the hazard was identified, and the steps taken to eliminate, isolate, minimise and monitor the hazard.

The Contractor shall have and comply with its own appropriate Site specific safety and health plan which shall ensure all relevant places of work are safe, that hazards are controlled and that compliance with all health and safety laws is achieved. The Contractor shall submit its project specific safety and health plan to the Engineer at least 14 days prior to commencing any work on the Site. The Contractor shall review the plan regularly and shall ensure that it is maintained so as to be up to date and fully compliant with all Laws.

The Contractor shall comply with any health and safety plans currently implemented on the Site. Failure to comply with existing health and safety plans may result in the Engineer instructing the Contractor to cease or not commence furnishing the Works or part of the Works until the Contractor complies with its health and safety obligations required pursuant to this Contract. Any such instruction shall not constitute a Variation and the Contractor shall not be entitled to any extensions of time or any compensation as a result of such instruction.

The Engineer may audit the Contractor from time to time on any aspect of its activities or procedures as they relate to safety and health. If the Engineer is of the opinion that the Contractor has failed to comply with any part of this Sub Clause the Engineer may advise the Contractor and may instruct the Contractor to cease or not commence furnishing the Works or part of the Works until the Contractor complies with its health and safety obligations required pursuant to this Contract. Any such instruction shall not constitute a Variation and the Contractor shall not be entitled to any extensions of time or any compensation as a result of such instruction.

If any employee of the Contractor or any Subcontractor suffers an injury while furnishing the Works which results in the employee's death or inability to work for any part of the next day or shift scheduled for work, the Contractor shall inform the Engineer forthwith and as soon as practicable shall provide details on the Employer's standard "Event Report" form.

For statistical purposes, the Contractor shall provide in writing, with each monthly progress report, the total hours worked during the previous month on the Site by its staff and also separately by its

Subcontractors. Staff shall include supervisory and administrative staff. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

The Contractor shall also comply with any safety provisions included in the Specification."

6.9 Contractor's Personnel

Add the following:

"The Contractor shall employ the key personnel named in the Tender to fill the positions stated in the Tender, or, where it is unable to do so, shall employ others approved by the Engineer pursuant to this Sub Clause 6.9".

The Contractor shall not without the prior consent of the Engineer replace any of the approved key personnel.

The Engineer shall not be required to approve a proposed replacement key person unless such person's relevant qualifications and experience are at least as good as those of the person who is to be replaced. Otherwise, the Employer's approval to any proposed replacement key person shall not be unreasonably withheld".

7 Plant, Materials and Workmanship

7.1 Manner of Execution

Add to the end of Sub-Clause 7.1

Unless otherwise specified in the Contract, all Materials used other than Temporary Works shall be new.

The Contractor expressly acknowledges that the Employer entered into the Contract in reliance upon:

(a) the skill and judgement of the Contractor as a designer, manufacturer, supplier, installer, programmer, tester and commissioner of facilities of the size, nature and standard of the Works; and

(b) the ability of the Contractor to design, manufacture, supply, install, programme, test and commission the Works with the highest regard to the environment and to the safety of workers and all other persons at or in the vicinity of the site, the Works and the property of third parties.

Add new Sub-Clause 7.1(d)

The Contractor shall also provide the raw materials, utilities, lubricants, chemicals, catalysts, Works, services and other matters required for testing and commissioning. The Contractor must provide all operating staff prior to Taking Over for testing and commissioning.

7.7 Ownership of Plant and Materials

The Contractor warrants that the Plant and Materials are or will at the point that ownership transfers to the Employer pursuant to this Sub Clause 7.7 and until the date of issue of the Taking-Over Certificate, be free of any lien, pledge, mortgage, charge, or encumbrance whatsoever (save in respect of any rights acquired by the Employer) and in the case of any Security Interest existing over any of the Plant or Materials (or part thereof), the Contractor shall register or procure the registration of a financing change statement wholly releasing each such Security Interest prior to transfer of ownership to the Employer pursuant to this Sub Clause 7.7.

8 Commencement, Delays and Suspension

8.3 Programme

Delete the first two sentences of the first paragraph and substitute:

"The Contractor shall prepare a revised programme when required to do so by the Specification, or when instructed to do so by the Engineer. The period within which the Contractor shall submit a revised programme for approval, either having been asked to do so by the Engineer or following disapproval of a previous submission, is 7 days. Each revised programme shall show the effect of Variations, extensions of Time for Completion granted and how any delays are to be dealt with. The form of the programme shall be as set out in the Specification."

Add the following after (d)(ii):

"(e) Any other requirements set out or required by the Specification."

9 Tests on Completion

9.4 Failure to Pass Tests on Completion

Add to the end of Sub Clause 9.4 (a):

"The Contractor shall at no cost to the Employer rectify, modify or replace the Plant and repeat the Tests as often as may be determined by the Engineer acting reasonably until the said Tests have been passed."

Add the following to Sub-Clause 9.4

If the Contractor does not attend the Tests on Completion, the tests shall be deemed to have been conducted with the consent of the Contractor and the results of the tests shall be accepted as accurate.

9.5 Tests after Completion

Add new sub-clause

Should the Engineer approve Tests on Completion or Functional Guarantee Tests taking place after Taking Over, the requirements of Clause 12 as modified by the Particular Conditions shall apply.

10.3 Interference with Tests On Completion

Add new paragraph to before the final paragraph of this Clause

Nothing in this clause shall prevent the Engineer from instructed that the Tests on Completion be carried out as Tests after Completion

11 Defects Liability

11.9 Performance Certificate

Delete the second paragraph and substitute:

"The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon as practicable thereafter, provided that the Contractor has supplied all the Contractor's Documents, completed and tested all the Works, including remedying any defects, and received an Acceptance Certificate pursuant to Sub Clause 12.5. For the avoidance of doubt, the Engineer shall not be obliged to issue the Performance Certificate until all of the above conditions have been satisfied."

Add the following at the end of the Sub Clause:

"The issue of the Performance Certificate shall not relieve the Contractor from any liability in respect of:

(a) fraud or dishonesty relating to the Works or any part thereof or to any matter dealt with in the Performance Certificate;

(b) any incidental or erroneous inclusion or exclusion in the Performance Certificate;

(c) any unresolved issues the subject of a notice of dispute pursuant to Sub Clause 20.2, served before the seventh day after the issue of the Performance Certificate

(d) any other deed or agreement entered into between the Employer and the Contractor (whether or not with any other parties) relating to all or any part of the Works."

11A Supplier Warranties

Add a new Clause:

"The Contractor shall obtain from any supplier of Plant for the Works warranties for defective product and workmanship ("the Supplier Warranties") on the relevant suppliers' usual commercial terms and for a period agreed upon between the Employer and the Contractor (acting reasonably) which period shall in any event not be less than, nor expire prior to expiry of, the Defects Notification Period. To the extent permissible the Supplier Warranties shall be assigned by the Contractor to the Employer to the intent that the Employer shall be entitled to the full benefit of such warranty. To the extent that the Supplier Warranties are not assignable, they shall be held on trust by the Contractor for and on behalf of the Employer to the intent that as between the Employer and the Contractor, the Employer shall be entitled to the full benefit of the Supplier Warranties. The Supplier Warranties shall not limit the obligations placed on the Contractor under this Contract. The Contractor shall take all necessary and reasonable steps to assist the Employer in the enforcement of any Supplier Warranties.

12 Tests After Completion

12.1 Procedure for Tests after Completion

Delete the first sentence of Sub Clause 12.1 and replace with the following:

"If Tests after Completion are specified in the Contract, or if the Engineer agrees to Tests on Completion being delayed until after Taking Over in accordance with Clause 9.5 of the Particular Conditions, this Clause shall apply:"

12.5 Acceptance Certificate

Add the following new Sub Clause to Clause 12:

"The Engineer will issue an Acceptance Certificate when the Works have met all requirements for Taking Over, and the Recommissioning Tests detailed in Part 11 for each Section have been completed either as part of the Tests on Completion or have been completed after Taking Over as Tests After Completion and fully meet all of the obligations under this Contract. The issue of an Acceptance Certificate does not affect the Defects Notification Period.

The Contractor may apply by notice to the Engineer for an Acceptance Certificate in respect of the Works or, if the Works are divided into Sections, in respect of each Section, at any time after completion of the Tests after Completion.

The Engineer shall, within 28 days after receiving the Contractor's application:

(a) issue the Acceptance Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and/or defects which will not affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and/or these defects are remedied); or

(b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Acceptance Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub Clause."

13 Variations and Adjustments

13.5 Provisional Sums

Delete the second sentence in (b)(ii)

13.8 Adjustments for Changes in Cost

Delete the Sub Clause and insert:

As stated in the Appendix to Tender the Contractor shall be permitted to adjust the price as the works proceed using the index method that is agreed at the commencement of the Contract, as detailed in the Letter of Acceptance.

(Add new paragraph to end of sub-clause)

Where a variation is granted the price shall be valid from the date the Engineer approved the Variation rather than from the Base Date.

14 Contract Price and Payment

14.1 The Contract Price

(Add the following to sub-paragraph (e) as follows)

However, the Contractor shall be responsible for the payment of any redeemable bond posted by the relevant authorities in the Country in relation to the importation of the Contractor's Equipment.

14.6 Issue of Interim Payment Certificates

Replace the first paragraph of this Sub Clause with the following;

"No amount will be certified or paid until the Engineer has received and approved the Performance Security and the certificates of insurance required from the Contractor in accordance with Clause 18 [Insurance]. Thereafter, the Engineer shall after receiving a Statement and supporting documents, issue to the Employer an Interim Payment Certificate

which shall state the amount which the Engineer fairly determines to be due, with supporting particulars."

14.7 Payment

Add the following Sub Clause

14.7.1 Interim Payment Procedure

The procedures and timing for interim progress payments shall be as follows:

(a) Each Statement shall be in writing and comply with the requirements of the Contract.

(b) The Contractor shall submit each Statement to the Engineer by the seventh day of the month following the month in respect of which the Statement is calculated.

(c) Within seven days of receipt of each Statement the Engineer shall issue a Payment Certificate in respect of the Statement and provide a copy to the Contractor.

(d) Each Payment Certificate shall identify the Payment Claim to which it responds, indicate the amount that the Engineer fairly determines to be due and show the manner in which the amount due has been calculated.

(e) If the amount indicated on a Payment Certificate differs from the amount claimed in a Statement, the Payment Certificate will provide reasons for the difference.

(f) The Contractor shall submit a tax invoice to the Employer for the amount to be paid as shown on a Payment Certificate within five days of receipt of the Payment Certificate.

(g) Subject to compliance by the Contractor with the provisions of this Sub Clause, the Employer will pay the invoiced amount within 56 days following receipt of the Contractor's tax invoice.

(h) For the purposes of interpreting the requirements of the Contract:

(a) The Employer acknowledges that all Payment Certificates issued by the Engineer shall be regarded as payment schedules and that the Engineer has the full authority and support of the Employer in issuing such payment schedules or certificates in the Employer's name; and

(b) The Contractor acknowledges that the Engineer has the full authority and support of the Employer in issuing the payment schedules or certificates and the Contractor acknowledges that the Employer can only make payment against correct tax invoices prepared by the Contractor for the amount specified in the payment schedules or certificates."

14 Delayed Payment

Delete the second paragraph and substitute:

"Financing charges shall be calculated using the annual interest rate as set out in the Appendix to Tender."

14.11 Application for Final Payment certificate

Delete the last sentence and substitute:

"Thereafter, if the dispute is finally resolved under Clause 20, the Contractor shall then prepare and submit to the Employer (with a copy to the Engineer) a Final Statement.

14.13 Issue of Final Payment Certificate

Add at the end of the Sub Clause:

"The Contractor shall submit a tax invoice to the Employer for the amount to be paid as shown on the Final Payment Certificate within five days of receipt of the Payment Certificate.

Subject to compliance by the Contractor with the provisions of this Sub Clause, the Employer will pay the invoiced amount within 56 days following receipt of the Contractor's tax invoice."

14.15 Currencies of Payment

Add at the end of the Sub Clause:

"No adjustment of the Contract Price shall be made for any fluctuations in the rate of exchange between the currency of the Contractor's country of origin and any other currency."

14.16 Fiji Islands Taxation

Add new Clause 14.16 and sub-clauses 14.16.1 to 14.6.8

14.16.1 Fiji Value Added Tax, Withholding Tax and Contract Price

(*Add a new sub-clause 14.16.1 stating)*

The offshore and onshore prices shall exclude Fiji Value Added Tax (VAT) and Fiji Withholding Tax.

The Contractor will be able to recover any applicable Fiji Value Added Tax through adjustments to any claims for payment, if required. Refer to Clause 14.16.5.

The Contractor will be able to recover any applicable Fiji Withholding Tax through adjustments to any claims for payment, if required. Refer to Clause 14.16.7.

The Contractor will be instructed how to present invoices which will include instructions concerning the inclusion of Withholding Tax and Value added Tax at the relevant rate at the time.

14.16.2 Offshore Country Withholding Taxes, Goods and Services Taxes, Duties and other Taxes

(*Add a new sub-clause 14.16.2 stating)*

The offshore and onshore contract prices shall include all offshore country withholding taxes, goods and services taxes, duties and all other taxes, levies or charges.

14.16.3 Contractor to inform itself concerning Fiji tax obligations

(*Add a new sub-clause 14.16.3 stating)*

The Contractor is required to obtain all necessary advice and to inform themselves independently over all matters concerning tax obligations in Fiji and other countries

14.16.4 Tax Residency in Fiji

(*Add a new sub-clause 14.16.4 stating)*

Where a Contractor is operating in Fiji for more than 6 months in a single tax year, FRCA will, for tax purposes, consider the Contractor to be a Permanent Establishment and the Contractor will be subject to Fiji taxation as if the Contractor was operating as a registered entity.

14.16.5 Value Added Tax (VAT)

(Add new Sub-Clause 14.16.5 as follows)

Where any supply occurs under or in connection with the Contract or Works for which VAT is not otherwise provided, the Contractor shall be entitled to increase the amount payable for the supply by the amount of any applicable VAT. The Rate at the Commencement Date is 9%.

The Employer will not be obliged to pay any amount in respect of VAT to the Contractor unless and until a tax invoice that complies with the VAT legislation has been issued in respect of that VAT.

Off - Shore Work

All invoices issued for off-shore work pursuant to this Contract shall be expressed in the foreign currency stated in Appendix to Tender, and will be issued using Contractor's overseas office letterhead. No GST or VAT shall be included in the invoice. Payment of the foreign currency shall be paid at as at the date of payment.

The Employer shall pay the invoice amount in foreign currency to each overseas bank account nominated by Contractor within 56 days of receipt of the invoice.

On - Shore Work – Fiji Registered Entities

All invoices issued for on-shore work pursuant to this Contract from Fiji registered identities shall state the foreign currency amount and the VAT amount in Fiji dollars. The Value Added Tax due is calculated by converting any foreign currency amounts to Fiji dollars using the corresponding foreign exchange rate prevailing on the date of the invoice. Any Value added Tax (VAT) amount component at the prevailing VAT rate shall be added to indicate the VAT inclusive price (VIP). The invoice shall be issued using Contractor's Fijian registered entity letterhead. The current VAT rate at the Commencement Date is 9%.

The Employer shall pay the amount agreed to be in foreign currency to a Fiji based foreign currency bank account nominated by the Contractor. The Employer shall pay the amount agreed to be in Fiji dollars including the VAT amount to a local bank account nominated by the Contractor.

The Employer shall pay the invoiced amounts within 56 days of receipt of the invoice.

The Contractor shall advise the Employer the details of its Fijian registered entity including the Tax Identification Number given by Fiji revenue and Customs Authority (FRCA) as soon as possible after the execution of this Agreement.

The Employer shall not be responsible to pay invoices issued by the Contractor or its Fijian registered entity if such invoices are not in conformance with the above stated requirements.

On - Shore Work –Entities not registered in Fiji

Invoices from identities not registered in Fiji can be expressed in foreign currency. No Value Added Tax is due and no amount is required to be added... Payment procedures shall be agreed with the Employer at the time.

The Employer shall pay the invoiced amounts within 56 days of receipt of the invoice.

14.16.6 Provisional Taxation

(Add new Sub-Clause 14.16.6 as follows)

(Add new paragraph to Particular Conditions clause 14.16 stating):

The Employer will deduct provisional tax at the specified rate of 5% at the Commencement Date of the gross invoiced amount of each invoice submitted by the Contractor for services carried out in Fiji.

Explanatory note:

Provisional Tax is domestic income tax deducted at source at a rate of 5 percent on the VAT exclusive price of services and paid to the FRCA by the Employer. Provisional tax applies to on-shore services provided by the Contractor resident in Fiji for tax purposes.

This provisional tax is claimable by the Contractor when end-of-year tax returns are submitted to FRCA, provided that the Contractor is registered as a tax payer in Fiji

Provisional Tax is not deducted if Withholding Tax is deducted.

14.16.7 Withholding Tax

(*Add a new sub-clause 14.16.7 stating :)*

The Contract price shall exclude Fiji Non-Resident Withholding Tax. The Contractor will be able to recover any applicable Fiji Withholding Tax through adjustments to any claims for payment, if required. The Contractor will be instructed how to present invoices which will include instructions concerning the inclusion of Non-Resident Withholding Tax and Value Added Tax at the relevant rate at the time.

Notwithstanding any other provision of this Contract to the contrary, the Contractor shall not be required to allow for any Withholding Tax (**"WHT"**) whatsoever. The Employer shall be responsible for the payment of any applicable WHT to FRCA. The rate of Withholding Tax at the Commencement Date is 15%.

In general withholding tax will be deducted at the current rate from invoices for onshore work where the Contractor invoice is not in the name of a company registered in Fiji. The withholding tax will not be deducted from invoices from companies that are registered in Fiji.

Withholding tax may be deducted at the applicable rate from invoices for offshore work depending on the type of work and the country of origin.

Note that the invoice from the Contractor shall include the value of any applicable Withholding Tax. The Withholding tax portion of the invoice is paid by the Employer directly to FRCA and the balance is paid to the Contractor.

The Contractor shall obtain clearance from FRCA, that for the purposes of this contract, it fulfils the requirements for a Permanent Establishment for tax purposes in Fiji. If the FRCA confirms that the Contractor, under the Fiji Income Tax Act qualifies as a Permanent Establishment, the Contractor shall register a branch in Fiji, pay the mandatory Fiji provisional tax at the applicable rate and lodge its Company tax return in Fiji. The non-resident withholding tax will not apply.

Should the FRCA agree that this contract does not fulfil the requirements for the Contractor to be Permanently Established in Fiji, then any services component of the Contract, as defined for tax purposes in Fiji, will be subject to the Non Resident Withholding Tax at the applicable rate. In this case, the Contractor will be required to submit a letter from the Tax Authority in the Contractor's home country explaining whether any tax credit against withholding tax is available in the home country. The Non-Resident Withholding Tax will be deducted by the Employer from all of the Contractor's invoices for the services component of the Contract, as defined for tax purposes in Fiji.

Explanatory note:

WHT may be applicable on specified payments to non-residents, as defined in Fiji's Income Tax Act (Budget Amendment) Decree 2001 and subsequent amendments or relevant double tax agreements.

WHT is usually payable at the applicable rate on onshore work where a Contractor is non-resident in Fiji. WHT can also be

payable at the applicable rate on the services component of offshore portions of contracts.

WHT may be available as a credit against income tax in the home country of the non-resident Contractor.

14.16.8 Contractor Home Country Tax Credits

(*Add a new sub-clause 14.16.8 stating)*

The Contractor may receive tax benefits in the home country owing to:

- Tax credits received in the home country against non-resident withholding tax payments in Fiji;
- Tax credits received in the Contractor's home country as a result of the operation of a permanent establishment in Fiji.

The Contractor is required to provide a written undertaking as part of this Contract Agreement stating that they will exercise their best endeavour to both maximise any tax credits as a result of working in Fiji in the Contractor's home country and to refund these tax credits in the home country to the Employer.

14.16.9 Company Tax

(*Add a new sub-clause 14.16.9 stating)*

The Contractor is responsible for paying all income tax due on profits earned in Fiji. The Employer will not compensate the Contractor for this taxation.

14.16.10 Personal Tax

(*Add a new sub-clause 14.16.10 stating)*

The staff of the Contractor are responsible for paying all income tax due on income earned in Fiji. Similarly any superannuation related issues such as FNPF liabilities (where applicable) shall be the responsibility of the Contractor and its Fijian registered entity. The Employer will not compensate the Contractor, or its staff, for this taxation, regardless of whether the staff are Fijian nationals or residents of another country.

14.17 Direct Payment

(Add new Sub-Clause 14.17 as follows)

Before issue of the Final Payment Certificate, the Employer may pay unpaid moneys owed by the Contractor to a worker or a subcontractor directly to that worker or subcontractor, where:

a) permitted by law;

b) given a court order in favour of the worker or subcontractor;

c) Requested in writing by the Contractor.

Such payment made to a worker or subcontractor in compliance with a legislative requirement shall be deemed to be part-satisfaction of the Employer's obligation to pay pursuant to Sub-Clause 14.7 [Payment].

15 Termination by Employer

15.2 Termination by Employer

Add the following sub-paragraph (g):

"(g) commits any other material breach of the Contract which is not remedied within 14 days of receiving notice of the breach from the Employer,"

Add the following at the end of the last paragraph of Sub Clause 15.2:

"Without limiting the foregoing provisions, upon termination of the Contractor's employment under the Contract, the following shall apply:

(a) the Contractor shall, when and if required by the Employer, assign to the Employer all of its rights under all or any of the subcontracts;

(b) the Contractor shall co-operate with the Engineer in the transfer of information and disposition of work in progress so as to mitigate the cost to the Employer of the termination of the Contractor's employment;

(c) the Contractor shall comply with all other reasonable requests from the Engineer and co-operate with and provide all reasonable assistance to the successor contractor (if any) and/or the Employer following the termination of the Contractor's employment to ensure that there is a smooth and efficient handover of the Works to any successor contractor and/or the Employer as the case may be;

(d) if requested to do so by the Employer, the Contractor shall assign to the Employer any or all of the Contractor's rights under the Contractor's shipping documentation (if any) for items of Plant and/or Materials to be supplied for incorporation into the Works and execute all documentation and do all things reasonably required by the Employer to effect such assignment, within 14 days of being requested to do the same;

(e) the Employer may pay any Subcontractor for any Materials or Goods delivered or works executed for the purpose of the Contract (whether before or after date of termination) insofar as the price thereof has not already been paid by the Contractor. Payments made under this Sub Clause may be deducted from any sums due or to become due to the Contractor. It is a condition of this contract that the Contractor is entitled to be paid any such sum as, in the event of termination and the making of any direct payments pursuant to this Clause 15 [Termination by Employer], may remain after the amount equivalent to such direct payment has, in addition to any other amounts certified by the Engineer under this Sub Clause, been debited against the Contactor;

(f) the Contractor shall provide to the Employer upon request and as a precondition to receiving any payment under this Clause 15 [Termination by Employer], such evidence as the Employer shall reasonably require to satisfy the Employer that property in all Plant and Materials which have been supplied by the Contractor to the Employer has vested (or will upon such payment vest) in the Employer."

17 Risk and Responsibility

17.4 Consequences of Employer's Risks

First paragraph, delete the word "Goods" in the second line.

17.6 Limitation of Liability

Add the words:

"Sub Clause 8.7 *[Delay Damages]*" *after the word* "under" *on line 3.*

18 Insurance

18.1 General Requirements for Insurances

Fourth paragraph; replace the first sentence with the following:

"Where the Contract requires insurance to be effected in joint names:

1. The cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured.
2. The policy or policies shall provide for waiver of subrogation with respect to each of the insured."

Sixth paragraph; replace "the respective periods stated in the Appendix to Tender" *with* "14 days".

18.2 Insurance for Works and Contractor's Equipment

The Employer shall be the insurer for project works on site. The Contractor is responsible for the insurance of the Project Works while in their possession and in transit to and from the site.

Fourth paragraph, sub-paragraph (d), replace

"the amount stated in the Appendix to Tender" *with* "$AUD50,000.00 or as may otherwise be agreed by the Employer".

18.3 Insurance against Injury to Persons and Damage to Property

Third paragraph, delete sub-paragraph (d)(i)

18.5 Professional Indemnity Insurance

Add the following new Sub Clauses to Clause 18:

"The Contractor shall effect and maintain professional indemnity insurance, which shall cover the risk of professional negligence in the design of the Works, for an amount not less than that specified in the Appendix to Tender for any one claim or series of claims arising out of the same occurrence.

18.6 Motor Vehicle Third Party Liability Insurance

"The Contractor shall effect and maintain, until expiry of the Defects Notification Period, motor vehicle third party liability insurance for an amount not less than that specified in the Appendix to Tender for any of the Contractor's vehicles used and operated in Fiji."

20 Claims, Disputes and Arbitration

Delete Sub Clauses 20.2 to 20.8 inclusive and substitute the following Sub Clauses:

20.2 Disputes

"If either party is dissatisfied with a decision or instruction of the Engineer, or if no decision is given by the Engineer within a prescribed time frame under this Contract or there is some other dispute between the Contractor and the Employer in relation to this Contract, then the dissatisfied party may refer the matter to mediation or arbitration pursuant to Sub Clauses 20.3 or 20.4 respectively.

Unless the dissatisfied party has notified the other party and the Engineer within 28 days of such decision or instruction of its intention to refer the matter to mediation or arbitration it shall be deemed to have accepted the decision or instruction as final."

20.3 Mediation

"Where a request for mediation is made the parties shall endeavour to agree on a mediator and shall submit the dispute to him/her. The mediator shall discuss the matter with the parties and seek to resolve the dispute by agreement. All discussions in mediation shall be without prejudice and shall not be referred to in

any later proceedings. The parties shall bear their own costs in the mediation and shall each pay half the costs of the mediator.

The parties may at any stage agree to invite the mediator to give a decision to determine the matter. The mediator's decision shall in such case be binding on both parties unless within 14 days either party notifies the other in writing that it rejects the mediator's determination.

If:

(a) Mediation has been requested but has not been agreed upon within 14 days of the request, or

(b) Within 14 days of mediation being requested the parties have been unable to agree upon a mediator, or

(c) No agreement has been reached in mediation and no determination has been issued by the mediator within 56 days of the request for mediation, or

(d) either party has, within the prescribed time rejected the mediator's determination,

then the matter may be referred to arbitration."

20.4 Arbitration

"A notice requiring arbitration shall be in writing and shall be given by the dissatisfied party in accordance with the time frame in Sub Clause 20.2 [*Disputes*] or within 28 days after the happening of the event in Sub Clause 20.3 [*Mediation*] which gives rise to the arbitration.

Arbitration shall be in accordance with the Rules of Arbitration of the International Chamber of Commerce (ICC). The law governing the procedure and administration of any arbitration is Republic of the Fiji Islands law. The place of arbitration shall be Suva, The Fiji Islands

The arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, direction certificate or valuation of the Engineer and to award on all questions referred to him/her. Neither party to the arbitration shall be limited to the evidence or arguments put before the Engineer or put before a mediator.

No decision given by the Engineer in accordance with his/her duties under the Contract shall disentitle him/her from being called as a witness and giving evidence before any hearing on any matter relevant to the dispute.

Where the matter has been referred to mediation the mediator shall not be called by either party as a witness, and no reference shall be made to the determination, if any, issued by the mediator in respect of the matter in dispute."

20.5 Works to Continue

"Performance of the Contract shall continue during mediation or arbitration proceedings unless the Employer shall order suspension. If any such suspension is ordered the documented costs incurred by the Contractor and occasioned thereby shall be added to the Contract Price.

No payments due or payable by the Employer shall be withheld on account of pending reference to mediation or arbitration."

Appendix and Annex

delete

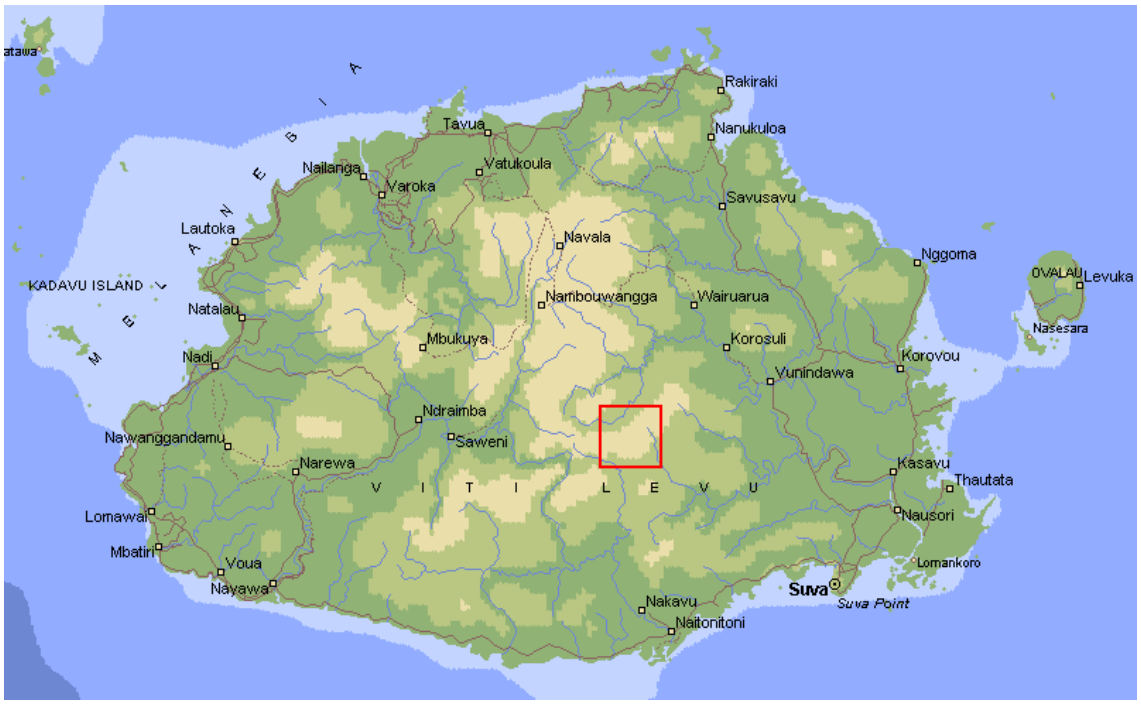
5. Specification – Preliminary and General

5.1 General

5.1.1 Location

The Site of the proposed Works is the Wailoa Power Station on Viti Levu in the Republic of the Fiji Islands. The site is normally accessed by road from the Capital, Suva.

Figure 5-1: Viti Levu Island Fiji. Approximate site location shown in red box



5.1.2 Access

Only construction vehicles will be allowed in the construction zone. All other vehicles shall be parked in the designated contractor staff car parking areas. Four wheel drive vehicles are required to access the site.

5.1.3 Site

The Contractor and his/her staff shall comply with the Employer's requirements for external contractors when working on the Site.

5.1.4 Construction Activities to be provided by the Employer

The Employer will provide the following services and construction work as part of this project;

a) Provide accommodation, free of charge for the Contractor's installation supervision and commissioning personnel at Wailoa Camp which is approximately one kilometre from the power station or at the Monasavu Camp which is approximately 10 km from the power station. The contractor will need to arrange their own food but the Employer can assist in arranging a cook and cleaner to be available;

b) The Contractor must provide its own accommodation at other locations in Fiji;

c) The Contractor is required to co-operate with the Employer in all respects in the provision of these services.

5.2 Payments

5.2.1 Offshore Part

Payment will be made on completion of milestones as set out below:

Milestone	Milestone Payment Basis	Cumulative Payment	Documents to be Presented
	The following applies to Section 1 (Offshore)		
Advance Payment	10% of the Accepted Contract Amount (Offshore Part)	10% of the Contract Price (Offshore Part)	• Commercial invoice • Advance Payment Guarantee and Performance Security
Purchase of computer hardware and software licenses.	20% of Contract Price (Offshore Part)	30% of Contract Price (Offshore Part)	• Commercial Invoice • Proof of purchase of computer hardware and software licenses
Development of PLC code and HMI screens to 50% completion and Factory Test plan.	25% of Contract Price (Offshore Part)	55% of Contract Price (Offshore Part)	• Commercial Invoice • Submittal of Factory Test Plan. • Submittal of printouts of HMI screens and PLC code demonstrating progress made.
Completion of factory acceptance tests of PLC code and HMI package. Submittal of Site Test Plan.	35% of Contract Price (Offshore Part)	90% of Contract Price (Offshore Part)	• Commercial Invoice • Submittal of Site Test Plan. • Successful completion of the factory acceptance tests and acceptance thereof by the Engineer.
Approval of the Operation and Maintenance Manual for the control system and operator interface (HMI)	10% of Contract Price (Offshore Part)		• Commercial Invoice • Approval of the Operation and Maintenance Manual for the control system and operator interface (HMI)
Defects Notification Period	Covered by a 10% Performance Bond reducing by 25% at the end of the Defects Notification Period for each of Sections 2 to 5.		

Delivery shall mean delivery to the project site or other store in The Fiji Islands as may be approved by the Engineer. For overseas sourced items manufactured specifically for this contract, payment will be made on presentation of certified shipping documents.

5.2.2 Onshore Part

The Onshore Part payments shall be on a Time and Materials basis with the Contract Price based on a pre-estimate of the number of days of On-Site work required to complete each Section (2-5) within the prescribed timeframes. This pre-estimate shall include travel, accommodation (when away from site), vehicle rental and expenses. The Contractor should allocate a suitable number of personnel required to complete the site work in the prescribed timeframes. It is expected that a minimum of two people will be

required throughout the On-Site activities. Change Orders will be used to adjust the Contract Price for any variance (increase or decrease) between the pre-estimate and actuals. Such adjustment shall be made following Acceptance of each of Sections 2 through 5.

The pre-estimated number of days of On-Site work per section are set out below:

Section 2 (First unit, HMI system and training)	80 man-days
Section 3 (Second unit)	50 man-days
Section 4 (Third unit)	50 man-days
Section 5 (Fourth unit, common and intake controls)	60 man-days

For avoidance of doubt, 'day' in the context of this clause refers to a working day, not a calendar day.

Payment for the Onshore Part will be made as set out below:

Milestone	Payment Basis	Documents to be presented
Installation and Commissioning	Time and Materials based on actual hours works, actual disbursement costs using the rates and markups as tendered by the Contractor. A 10% retention will be deducted from each payment.	• Commercial Invoice • Timesheets signed by the Employers site representative or Engineer. • Receipts for all disbursements claimed.
On Taking Over	50% of the retentions held.	• Commercial Invoice • Taking over certificate
On granting Acceptance Certificate	50% of the retentions held.	• Commercial Invoice • Acceptance certificate
Defects Notification Period	Covered by a 10% Performance Bond reducing by 25% at the end of the Defects Notification Period for each of Sections 2 to 5.	

5.3 Programme

The following programme shall apply for the completion of each of Sections 1 to 5 of the Contract. Please note one week equals seven days as defined in the General Conditions of Contract. All durations for each Section are cumulative starting on the Commencement Date of that Section.

Activity	Section 1 Duration	Section 2 Duration	Section 3 Duration	Section 4 Duration	Section 5 Duration
Development of preliminary HMI screens and PLC code (to a 50% level of completion)	4 weeks				
Comments provided for preliminary HMI screens and PLC code development.	14 days				
Completion PLC and HMI code	6 weeks				

Activity	Section 1 Duration	Section 2 Duration	Section 3 Duration	Section 4 Duration	Section 5 Duration
and factory acceptance testing					
Completion of Operation and Maintenance Manuals	14 days				
Approval of Operation and Maintenance Manuals	14 days				
Transport of computer hardware to site	6 weeks				
Commissioning, start-up and Tests on Completion		35 days	25 days	25 days	30 days
Operator Training		5 days			
Defects Liability Period	12 months	12 months	12 months	12 months	12 months
Total Duration (Days)	**212**	**304**	**414**	**487**	**557**
Preliminary Site Installation Dates					
Commencement date (Based on a 30 day allowance for arranging Advance Payment and security	5 March 2018	5 March 2018	5 March 2018	5 March 2018	5 March 2018
Factory Acceptance Test	11 June 2018				
Delivery of Section 1 equipment to Employers stores	6 August 2018				
Outage Commence		3 September 2018	14 January 2019	25 March 2019	6 June 2019
Tests on Completion Completed and Unit returned to service (Taking Over)		4 December 18	24 March 19	5 June 19	14 August 19

Activity	Section 1 Duration	Section 2 Duration	Section 3 Duration	Section 4 Duration	Section 5 Duration
Trial Operation Complete (Acceptance)		3 January 2019	23 April 2019	5 July 2019	13 September 2019
Defects Notification Period Ends		3 January 2020	23 April 2020	25 July 2020	13 September 2020

As numerous other upgrade works will be taking place concurrently on the turbine generator unit there will be no opportunity to commission each Section earlier than the scheduled dates.

5.4 Training

As part of this contract the Contractor shall include comprehensive training of the staff to levels suitable for accreditation to ISO 9001/2.

Included in the training shall be:

- Description of the entire control system
- Identification and function of all hardware and software components
- Operation of the control system (hands on) in all modes and from all locations
- Identification of faults and trouble-shooting
- Reloading software and backing-up data
- Performance assessment
- Routine maintenance and annual servicing procedures and requirements
- Reporting
- Safety
- Use of the Manuals.

The Contractor shall be required to demonstrate to the Engineer's satisfaction that he has adequately trained the nominated staff members so they are fully conversant with all aspects of operation, maintenance and procedures associated with the Plant.

The Acceptance Certificate will not be issued until all training requirements have been satisfied.

5.5 Tests on Completion

5.5.1 Tests on Completion

The Tests on Completion for each Section are detailed in Part 11 of the Specification.

5.5.2 Tests after Completion

It is expected that all Tests on Completion of the each unit control system will be completed before Taking Over is granted. However, the Employer may require some or all of the Tests on Completion to be carried out as Tests after Completion owing to station operating requirements.

5.5.3 Acceptance Certificate

When the above tests are successfully completed the Engineer will issue an Acceptance Certificate confirming the tests have been carried out and the test criteria has been met.

5.5.4 Performance Shortfall during Defects Notification Period

Should any performance shortfall be identified during the Defects Notification Period, the Contractor shall be responsible for taking immediate steps to determine and effectively correct the fault. The performance test shall be repeated by the Contractor after any resulting plant modifications.

5.6 Site Services

5.6.1 Electricity

A 230 VAC, two wire plus earth, single phase 50 Hz UPS power supply adequate for the Contractor's nominated requirements will be made available.

5.6.2 Water Supply

A potable water supply is not available at the Site for construction use. The Contractor will be required to make his own arrangements for the provision of bottled water and beverages for staff. .

5.7 Health and Safety

5.7.1 Health and Safety Procedures

The Contractor's and Sub-contractor's employees on Site shall adhere to the safety procedures established for the Site including: any lawful instruction given to them by an authorised person; emergency and evacuation procedures; the use of fire-fighting appliances; the observance of all industrial regulations relating to the Works; the observance of the shutdown of plant procedures and compliance with Site plant isolation procedures.

All Contractor employees including any Sub-contractor's employed on Site shall attend Site Induction Courses as required prior to the start of work on Site. All work on site shall be subject to and comply with the Site Health and Safety Policy, which is available to the Contractor upon request.

5.7.2 Health and Safety Regulations

The Contractor is required to ensure that the requirements of The Fiji Health and Safety at Work Act 1996 along with the Health and Safety in Employment Regulations and various Codes of Practice are observed by its own employees and those of his Sub-contractors and shall submit, prior to commencing the Works, a Site record sheet to the Engineer that confirms that all employee have been given the current information covering health and safety. The Contractor shall submit an updated Site record sheet weekly.

5.7.3 Accidents

The Contractor shall promptly report within 24 hours in writing to the Engineer all accidents and incidents that caused injury, illness and those that might have caused injury. In addition, if death, serious injury, or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Engineer and The Occupational Safety and Health Department. If any claim is made by anyone against the Contractor as a result of any accident, the Contractor shall promptly give a complete report of the facts in writing to the Engineer giving full details of the claim, including witnesses, statements, sketches and the like.

5.7.4 Safety Supervisors

The Contractor's Safety Supervisor nominated for the Site shall have their name displayed on all facilities and the person's name is to be known by all employees and in accordance with The Fiji Health and Safety at Work Act 1996. The Contractors Safety Supervisor shall be responsible for all safety matters and shall liaise with the Engineer.

5.7.5 Protective Helmets and High Visibility Jackets

The Employer will designate protective helmet areas. All Contractors' employees, sub-contractors employees, visitors and delivery personnel shall wear a hard hat at all times within such designated areas. Contractors must advise all appropriate people. Hard hats are to be replaced every three (3) years and are not to be painted. Only the company logo may be attached.

High visibility jackets shall be worn at all times and in all areas designated by the Employer.

5.7.6 Radios

No broadcast frequency radios, Walkman's, radio cassettes CD players, MP3 players, or other similar devices shall be permitted on the construction work areas.

5.7.7 Safety Signs

The Contractor's employees shall observe and comply with all safety signs displayed about the Site. These signs inform personnel both of safety equipment that is required and the hazards that personnel may encounter in special areas.

5.7.8 Alcohol & Illegal Drugs and Substances

Illegal drugs and substances are not permitted on Site. Alcohol must not be brought on Site or be consumed on Site unless approved by the Site Manager. Personnel reporting for duty or seen on Site under the influence of drugs, substances or alcohol will not be allowed to commence work and will be asked to leave the Site.

5.7.9 Animals

Animals are not permitted on Site.

5.7.10 Children

Children under the age of 15 are not permitted on Site.

5.7.11 Contractor's Responsibilities for Health and Safety

The Employer requires the Contractor to comply with safety regulations detailed herein. Compliance with these safety regulations shall not relieve the Contractor of his obligations under the Contract, The Fiji Health and Safety at Work Act 1996, and any amendments thereto.

The Contractor shall:

- Ensure that Contractor and Sub-contractor employees have the necessary skills, qualifications and are supervised by trained personnel to perform the contracted Works safely;
- Audit the performance of Contractor and Sub-contractor employees to ensure compliance to Health and Safety at Work Act 1996 and Site requirements and report each month in the prescribed form to the Engineer. In addition, the Contractor shall report weekly to the Engineer as to the total number of personnel (including Sub-contractors) employed on Site over the last week;
- Inform the Engineer of Health and Safety hazards presented by the Contractor's or Sub-contractor's Works;
- Inform the Engineer of Health and Safety hazards found by Contractor or Sub-contractor whilst undertaking Works;
- Ensure that Health and Safety equipment and clothing is supplied to protect Contractor and sub-contractor employees from the hazards their work creates and that all steps have been taken to prevent harm to other people in the area from the hazard created; and
- The Contractor has the responsibility for informing each Sub-contractor of Health and Safety hazards they may be exposed to and the controls in place to protect them including hazards that may be created by other contractors.
- The Contractor shall run minuted toolbox meetings involving all staff working on site.

5.7.12 Fire Regulations

The Employer shall provide and maintain adequate fire prevention equipment facilities in areas of potential fire hazard, including, but not limited to, portable fire extinguishers, fire protection mats and fire watchers. In the event of any fire, the Contractor shall take all steps necessary to extinguish the fire and contain its effects and shall report promptly in writing to the Engineer the cause and extent of damage resulting there from.

5.7.13 Housekeeping

The Contractor is responsible for keeping all work areas free from accumulated rubbish at all times and shall deposit rubbish in the central rubbish skips.

5.7.14 Responsibility - Employer

The Employer will:

- Document procedures for Contractor and Sub-contractor personnel movements in and out of the Site or nominated work areas;
- Advise the designated Site Health and Safety Officer;
- Facilitate regular Health and Safety meetings with Contractor's Occupational Health and Safety representatives; and
- Undertake Health and Safety Audits.

5.8 Contractor's Administration

5.8.1 Contractor's Supervisor

The Contractor shall appoint one of their personnel as supervisor to control and direct his staff at Site and the appointed supervisor or replacement approved by the Engineer shall be on Site whenever members of the Contractor's staff are working. The supervisor shall not be replaced except by agreement with the Engineer.

The Contractor's supervisor shall be entirely responsible for the direction of employees of the Contractor and shall be given authority to negotiate and agree points arising out of the works in order to minimise delays. All instructions from the Engineer will be issued to the appointed supervisor.

5.8.2 Meetings

Meetings will be convened by the Engineer at regular intervals which will not be less frequent than monthly and may be weekly at critical periods. The Contractor shall ensure that their supervisor attends each meeting.

5.9 Co-operation

The Contractor shall co-operate with Site staff, and other contractors on the Site as applicable, to ensure an orderly programme.

5.10 Site Operations

5.10.1 General

At all times the Contractor and his work force shall observe the Employer's requirements in regard to safety and power scheme operating conditions and shall carry out no acts which would, or have the potential to, cause damage or down-time of any Site operations.

5.10.2 Site Specific Entry Conditions

The Contractor is required to ensure that they and all employees and sub-contractors comply with all Site specific entry conditions as may be issued by the Employer from time to time.

5.11 Delivery Procedures

In the event of plant or sections thereof being supplied from outside The Fiji Islands, such plant shall be delivered to a port in the country of manufacture for direct shipment to the specified port in Fiji. Plant must not be shipped on deck unless in containers.

The Contractor shall:

- Verify that the packing is adequate and sufficient for the required land, ocean and/or air transit to the final destination determined by the Employer certifying in particular that the packing complies with Fiji Government Regulations;
- Verify that the wooden packing cases or timber used in packing machinery for shipment are free of bark and/or obvious insect damage, are certified and cleared by the overseas shippers and that all packing is clean and new;

- Indemnify the Employer against all liabilities, claims, costs and expenses that may result from failure of the Contractor to comply with the above mentioned conditions;

All wooden packing cases or timber used in packing machinery from overseas shall be fumigated prior to delivery to Site and following equipment unpacking it shall be delivered to a nominated Site area for incineration. This material shall not be used on Site for construction activities.

5.12 Manuals and As-Built Drawings

The Contractor shall provide three securely bound sets of Operating and Maintenance Manuals. A full draft manual shall be provided prior to the issue of a Taking-Over Certificate with three copies of the final revision provided, at least one copy to be on CD-ROM.

The information provided with each manual shall include but not necessarily be limited to:

- Serial numbers and manuals of the hardware and software package, including all individual components as applicable;
- Contact details for hardware and software suppliers and software licensing information
- Operating instructions for starting up, running and shutting down of the unit control systems;
- HMI screen images indicating the function and purpose of each control and monitoring point
- Full instructions for adjustments and settings;
- List of alarm and trip conditions
- List of tags for the communications interfaces, e.g. remote SCADA and governor
- Full commissioning and test records providing as-commissioned settings;
- Troubleshooting and fault finding guide for the control and HMI system
- Maintenance guide including replacing PLC and HMI hardware components, calibrating instrumentation, backing-up data, reinstalling and reloading software
- Functional descriptions and automation software programmes representing the as-installed PLC logic and listings including a copy in electronic form;

A copy of the Operating and Maintenance manual for the Employer's Nadarivatu Scheme is provided for reference in Appendix D. This is intended to provide an indication of the scope and level of detail expected.

The final format of all such manuals and drawings shall be agreed with the Engineer prior to their preparation.

Drawings shall also be supplied as hard copies and also in electronic form. All plant layout and P&ID drawings shall be provided in AutoCAD or similar format.

5.13 Documentation and Approvals

The Contractor shall allow 14 days for the approval by the Engineer of all drawings, schedules and documents as required under this Contract unless such lesser time is agreed in writing by the Engineer. The Contractor shall allow for up to four copies of each and every drawing and document necessary for the approval of the proposed plant and for the subsequent operation and maintenance of the plant. Electronic copies of CAD drawings shall also be provided in AutoCAD format.

5.14 Substitutions

All components and engineering specifications shall comply with the technical specification unless agreed to in writing by the Engineer.

Substitutions of alternative equipment or brands of component types shall be approved by the Engineer in writing prior to commitment and installation.

5.15 Industrial Relations

The Contractor shall keep the Engineer fully informed of all claims made or other industrial relations matters which may affect the Site or the Employer's activities and shall take all reasonable steps to avoid actions or inactions which will prejudice the Employer.

The Employer instructs the Contractor not to enter into any specific Site agreement, or redundancy agreements and shall not employ workers at the Site nor specifically for the Site nor specifically for this Contract but for general work at unspecified locations. Any actions in contravention of these preferences are likely to be prejudicial to the Employer and therefore not acceptable.

5.16 Quality Systems and Standard Compliance

The Contractor shall implement full Quality Management System procedures on all aspects of the Work from and including initial design to final documentation.

The Engineer reserves the right to arrange an independent assessment of the Contractor's or Plant Suppliers Quality Management System if quality systems procedures in use on the Contract are considered by the Engineer to be deficient.

5.17 Advertising

The Contractor shall treat the Contract and everything within it as private and confidential. In particular the Contractor shall not publish any information, drawing or photograph relating to the Works and shall not use the Site for advertising purposes except with the written consent of the Engineer and subject to such conditions as the Engineer may prescribe.

5.18 Existing Services

The Contractor is to leave all existing services, in place unless otherwise directed by the Engineer.

5.19 Protection of Works

Where required, the Contractor shall cover and protect the Works and all plant and equipment from inclement weather and damage as the Works proceeds. Any work, materials, plant or equipment suffering damage shall be made good at the Contractor's expense.

6. Specification - Introduction

6.1 Scope of Supply

The Contractor shall furnish all labour, materials and equipment required to for the development of Unit Control, Common Services and Intake PLC programmes, station wide HMI application, supply of HMI server and workstation hardware and software package, supply of commercial software licenses, supply of control desk and chairs, in-house testing, delivery to site, commissioning, start-up and testing of control system for four (4) existing turbine-generators.

PLC programmes will be developed for four "Unit PLC"s, one "Common Services PLC" and one "Intake PLC".

The Unit PLC code will handle the complete automation of the generating unit, including starting and stopping sequences, co-ordinating and monitoring of all auxiliary equipment. The code will allow fully automated start up and shut down of the unit as well as manual control of the individual auxiliaries. The code will detect fault and trip conditions, safely shut the unit down in the appropriate manner and report the fault to the HMI and remote SCADA system. The logic will be developed from the detailed Functional Descriptions and IO List provided in this Specification. The code will be nearly identical for all four generating units, except for scaling and tuning settings.

The Common Services PLC code will handle common station functions, such as security, fire detection, drainage, penstock flow metering etc., as well as coordinating the four Unit PLCs and communicating with the Intake PLC.

The Intake PLC will control and monitor equipment up at the tunnel intake.

The PLC logic is to be developed specifically for a defined PLC hardware configuration (*Schneider M580* platform) to be provided under a separate contract. The appropriate PLC programming software (*Unity Pro*) and licenses are to be provided under this contract. A list and physical layout of the selected PLC hardware is provided in this Specification.

The HMI (Human Machine Interface) package to be provided under this Scope will utilise *Wonderware System Platform* software. The package will include the supply of the commercial software licenses, development of a custom HMI application and graphics for the entire station control system to interface the Control system. It also includes computer hardware, including servers and server cabinet, operator workstations, printers, control desk and chairs and maintenance laptop. All hardware will be loaded with the necessary software and licenses, configured and tested to provide a fully working HMI system.

The scope includes commissioning and testing of the control software during reinstatement of each generating unit, according to the overall rehabilitation schedule. The commissioning will include PLC hardware configuration, software loading, point-to-point testing of all IO, testing the logic through all modes of operation, and verifying all trip conditions. The station HMI package shall be physically installed, connected, configured and tested at site to confirm full functionality and compatibility with the PLC system. The HMI will be installed and commissioned during the commissioning of the first unit.

Staff training will be provided on completion of the first unit commissioning and testing. The training will provide an overview of the complete unit control and HMI system. It will refer to the Operation and Maintenance Manual provided under this scope and include the following;

- Identification and function of all hardware and software components
- Overview of communications network, devices, interfaces and protocols
- Operation and Control of the unit via the HMI and from the remote SCADA interface
- Viewing trends and alarms
- Retrieving historical data
- Troubleshooting and fault finding using the HMI screens and PLC programming software
- Replacing PLC and HMI hardware and reloading software
- Backing-up of data

6.2 Existing Plant

6.2.1 Existing Generator Characteristics

Details of the existing turbine generator are set out below.

No of Units	4
Manufacturer	Bell of Switzerland
Turbine Type	Vertical Pelton
In Service Date	1983
Generator Rating	24,500 kVA, 0.85 pf
Turbine Generator Rating	20,570kW at 3.96 m^3/s
Generator Voltage	11,000 volts
Synchronous Speed	750 rpm
Runaway Speed from Turbine Data	1,320rpm
Number of Buckets	21
Number of Needles / Deflectors	4
Runner Installation Level	RL122m

6.2.2 Existing Control System

The existing unit control system is the original hard wired, relay logic based system. This existing cabinets will be removed and replaced with new control and protection cabinets housing the PLC hardware and circuitry.

7. Specification - General Requirements

The following paragraphs written in the singular form for one unit control system shall apply equally to all Unit, Common and Intake control systems furnished, except where specifically indicated otherwise.

7.1 Submittals

Submittals shall be provided in accordance with the requirements of Section 1.3 of the Common Requirements Specification.

7.2 Preliminary Code and Graphics

The following documents shall be provided:

a) Documents

- A printout of the PLC code, as developed at this point in the project schedule.
- A printout of the developed HMI graphics screens, showing layout of controls and monitoring points
- Factory acceptance test (FAT) plan and schedule

b) Files

- PLC programme files and/or HMI application files may also be requested for review

7.3 Manuals and Test Plans

The following documents shall be provided:

a) Operating and Maintenance manual

- Manual should contain the information set out in Paragraph 5.12 of this Specification

b) Factory test reports.

c) Instructions:

   a. Site commissioning plan and schedule
   b. Site acceptance test (SAT) plan and schedule
   c. Handling and Storage Instructions

7.4 Standards and Codes

The Contractor shall comply with requirements of the Common Requirements Specification and the latest revisions of applicable industry standards, specifically including the following:

- IEC 62270 - Guide for computer-based control for hydroelectric power plant automation
- IEC 61850 - Communication networks and systems for power utility automation

8. Specification – PLC Control Software

8.1 Hardware Description

The PLC hardware, for which the control software is to be developed, will be provided under a separate contract. The software must be developed specifically to suit the hardware configuration provided below. Each unit and Common Services PLC will utilise redundant processor racks supporting 4 remote IO racks, housed in two panels. The Intake control will utilise a single CPU. The following PLC hardware will be provided in each control panel:

Manufacturer	Schneider Electric
PLC Platform	Modicon M580
Redundancy	Level 2 Hot Standby CPUs

8.1.1 Unit Panel Hardware (for each of 4 Units)

Panel +#CJA01 Processor Racks

Quantity	Part No	Description
2	BMEXBP0800	8 Slots Eth Backplane
2	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMEH582040K	M580 LEVEL2 HSBY CPU KIT
2	BMENOC0301	M580 Ethernet Comm Module
2	BMENOR	DNP3 Communications for Redundant system

Panel +#CJA01 IO Rack 1

Quantity	Part No	Description
1	BMEXBP1200	12 Slots Eth Backplane
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMECRA31210	X80 EIO Drop Adapter With Eth Bkp
7	BMXART0814	ANA 8 TC/RTD ISOLATED IN
14	ABE7CPA412	WIRING BLOCK FOR 4 TC INPUTS
14	BMXFCA302	TEMPERATURE 3M CONNECTING CABLE

Panel +#CJA01 IO Rack 2

Quantity	Part No	Description
1	BMEXBP1200	12 Slots Eth Backplane
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMECRA31210	X80 EIO Drop Adapter With Eth Bkp
6	BMXAMI0810	Ana 8 U/I In Isolated Fast
6	BMXFTB2800	SCREW TERMINAL STRIP 28 STD. POINTS
1	BMXAMO0410	Ana 4 Current Out Isolated
1	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS

Panel +#CJA02 IO Rack 1

Quantity	Part No	Description
1	BMEXBP1200	12 Slots Eth Backplane
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY

Quantity	Part No	Description
1	BMECRA31210	X80 EIO Drop Adapter With Eth Bkp
7	BMXERT1604T	DIG 16I 24/125VDC TSTAMP
7	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
1	BMXNOM0200	BUS MODULE 2 RS485/232 PORTS
2	BMXDDO1602	DIG 16Q TRANS SOURCE 0.5A
2	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS

Panel +#CJA02 IO Rack 2

Quantity	Part No	Description
1	BMEXBP1200	12 Slots Eth Backplane
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMECRA31210	X80 EIO Drop Adapter With Eth Bkp
7	BMXERT1604T	DIG 16I 24/125VDC TSTAMP
7	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
2	BMXDDO1602	DIG 16Q TRANS SOURCE 0.5A
2	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS

8.1.2 Common Services Panel Hardware

+00CMA01 Processor Racks

Quantity	Part No	Description
2	BMEXBP0800	8 Slots Eth Backplane
2	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMEH582040K	M580 LEVEL2 HSBY CPU KIT
2	BMENOC0301	M580 Ethernet Comm Module
2	BMENOR	DNP3 Communications for Redundant system

+00CMA01 IO Rack

Quantity	Part No	Description
1	BMEXBP1200	12 slots Eth backplane
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMECRA31210	X80 EIO Drop adapter with Eth Bkp
4	BMXERT1604T	DIG 16I 24/125VDC TSTAMP
4	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
4	BMXDDO1602	DIG 16Q TRANS SOURCE 0.5A
4	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
2	BMXAMI0810	Ana 8 U/I In Isolated Fast
2	BMXFTB2800	SCREW TERMINAL STRIP 28 STD. POINTS

8.1.3 Intake Panel Hardware

+00CMA01 Processor & IO Rack

Quantity	Part No	Description
1	BMXXBP0800	8 SLOTS BACKPLANE

Quantity	Part No	Description
1	BMXCPS3020	HIGH POWER ISOL 24TO48 VDC POWER SUPPLY
1	BMXP342020	CPU340-20 MODBUS ETHERNET
2	BMXERT1604T	DIG 16I 24/125VDC TSTAMP
2	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
1	BMXDDO1602	DIG 16Q TRANS SOURCE 0.5A
1	BMXFTB2000	SCREW TERMINAL STRIP 20 STD. POINTS
1	BMXAMI0810	Ana 8 U/I In Isolated Fast
1	BMXFTB2800	SCREW TERMINAL STRIP 28 STD. POINTS

8.1.4 Supplied Drawings

The following drawings and schematics provide the physical layout of the PLC hardware. These are provided as part of the Tender package (Appendix A: Control System Architecture Drawings):

Drawing	Title
W1-CKA-SK01	Control System Architecture
W1-CJA-SK02	Protection System Communications Architecture
W1-CKA-SK03	Unit 1 PLC Architecture Sheet 1
W1-CJA-SK04	Unit 1 PLC Architecture Sheet 2
W1-CJA-SK05	Unit 1 Tripping Scheme

8.2 PLC Programming Software

The PLC programming commercial software required to develop and implement the Unit PLC code is to be supplied to the Employer under this Contract.

The software and license selected must be suitable for the hardware described above and allow full development, configuration, editing and monitoring functionality. The programming software will be *Schneider Unity V12 Pro L*, or as appropriate for the hardware.

Three licenses for the PLC programming software shall be provided. The licenses shall be registered in the Employer's name and installed on equipment provided under this contract. One license shall be loaded onto each Maintenance Laptop. The third license shall be loaded onto the Engineering Server Workstation. The computer hardware supplied under this contract is described under a later section.

8.3 PLC Code Development

The engineer or programmer responsible for developing, testing and commissioning the PLC code should be experienced in developing control systems for hydroelectric facilities.

8.3.1 Scope

PLC programmes shall be developed under this Contract for all of the PLC hardware outlined above. Complete, tested and working programmes shall be developed for:

- Unit PLCs (nearly identical code for each of the 4 generating units)
- Common Services PLC
- Intake PLC

This includes the complete and working application, that when loaded into the specified PLC hardware, will provide a fully functional control system.

The Unit Control PLC programme is responsible for:

- Fully automating the unit start-up and shut-down sequence

- Allowing automatic and manual control of the unit from local (HMI) and remote locations
- Coordinating and managing all of the unit auxiliary equipment, such as the cooling water system and high pressure lift oil system
- Monitoring the unit and issuing alarms and trips during abnormal conditions
- Safely shutting down the unit in the event of a mechanical or emergency trip
- Interfacing with the governor, inlet valve, excitation and protection systems
- Interfacing with the Common (station) control system via communications network
- Interfacing with the unit protection relay system via communications network.
- Interfacing with the Employer's remote SCADA system via communications network.

The Common Services PLC programme is responsible for:

- Station services such as fire system, security system, flood detection system
- Standby diesel generator and changeover system
- Interfacing with the Intake PLC
- Interfacing with the lower penstock flow meter
- Monitoring the Wailoa high voltage switchgear

The Intake PLC programme is responsible for;

- Controlling the Intake gate
- Monitoring of the intake gate and screen equipment
- Monitoring reservoir levels
- Interfacing with the upper tunnel flow meter

8.3.2 Functional Descriptions

Detailed functional descriptions are provided for the Unit PLC and form part of this Specification. Refer to Appendix B. These provide an outline of the tasks and logic to be developed for the Unit PLC.

The functional descriptions do not constitute the entire logic that will be required for the complete unit control. The software developer will need to use the descriptions as a reference and provide additional logic as required to produce a fully working programme.

Functional descriptions are not available for the Common Services or Intake PLC at this time. These will be provided after award of the Contract.

8.3.3 IO Lists

A hard wired IO (Input and Output) list is provided for the Unit PLC and forms part of this Specification. Refer to Appendix C. The list includes all of the physical input and output signals connected to the unit PLC IO modules. The list indicates the description of each tag and the address where the signal will be connected. The list included at tender stage is currently under development and the final version will be issued after Contract award.

Communicated IO lists will be provided after Contract award. These will cover the communications interfaces to be developed between PLCs and to other control devices. Refer to Paragraph 8.3.6 for the communications interfaces.

IO lists for the Common Services and Intake PLC are not available at this time. These will be provided after award of the Contract.

For estimating the extent of programming required for the Common Service and Intake PLCs, the IO counts based on the specified hardware should be used. For these programmes, the majority of the IO utilised will be for monitoring and alarming, with only a small amount of control functionality.

8.3.4 Programming Language

Schneider Unity Pro supports all of the IEC 61131-3 programming languages. The functional descriptions are presented mainly in *Function Chart* form, however the programmer may decide the most appropriate language to use for each task or routine. The language for each task should be selected with regard to ease of interpretation by others and simplicity of logic. The language choices should be consistent throughout the programme.

It is highly recommended that the main Start-Stop control sequence is programmed in *Sequential Function Chart*, while other routines either use the same or *Function Block Diagram*. *Structured Text* is least preferred, except where it may offer a distinct advantage over the other languages.

8.3.5 Programming Structure and Organisation

The entire programme should be developed with a focus on ease of interpretation and troubleshooting. The programming tasks should be well labelled and structured in a tidy, logical fashion. The tasks should be grouped according to equipment or function. Tasks or routines requiring extensive logic should be broken down into sub-tasks or routines. To aid comprehension and troubleshooting, very large routines should be avoided, as should excessive numbers of very small tasks.

Within each programme sheet, the logic should be laid out neatly so that it is easy to follow and all logic can be located quickly. This is especially important for *Function Block Diagram*. The logic should flow intuitively from left to right, top to bottom. The blocks and wire connections should be spaced adequately and placed in a tidy formation. Adequate but concise comments describing each part of the logic or task should be placed nearby the applicable logic.

All logic, including any user defined or add on blocks, should be "unlocked" or with password provided so that the Employer has full access to the code for maintenance and troubleshooting upon taking over.

Tasks should be configured for periodic scanning by the controller. The scan period should be set to a sensible value to avoid overloading the processor. A task scan period of 200 ms is likely to be adequate for most tasks in the unit controller.

All variables should use concise tag names with consistent naming convention. The KKS (Kraftwerks-Kennzeichen-System) designation system for power plants shall be used for physical IO tag names. A meaningful description should be entered for each variable. All discrete Input modules are Sequence of Event type. Time stamp data must be set up correctly so that this information is passed correctly to other devices and the HMI historian.

Tag names should not include the station name or the unit number so that the PLC tag database is common between units and to reduce manual entry of tags in the SCADA database.

Repeated use of user defined or add-on function blocks with large amounts of logic that is not utilised should be avoided to reduce unnecessary burden on the processer. The same applies to large array variables.

All unused logic, user-defined blocks and variables should be removed from the final programme.

8.3.6 Communications Interfaces

Communications interfaces will exist between the Unit PLC and:

- Turbine governor (Modbus TCP)

Approximately 50 variables used for control and monitoring

- Wailoa Station HMI (Ethernet)

Variables required for control and monitoring of the unit, and connected devices (governor, protection relays, vibration system)

- Common Services PLC (Ethernet)

Approximately 10 variables for co-ordinating the units

- Protection relay system (DNP3)

Approximately 100 input variables total from 4 relay devices for monitoring and alarming only

- Remote SCADA (DNP3)

Approximately 30 variables for remote control and monitoring

- Multifunction meter (Modbus RTU)

Approximately 15 analogue variables for monitoring

- Vibration system (Modbus RTU)
    - Approximately 15 analogue variables for monitoring and alarming

Communications interfaces will exist between the Common Services PLC and:

- Intake PLC (Ethernet)

Approximately 30 variables mainly for monitoring and a small amount of control

- Wailoa Station HMI (Ethernet)

Variables required for control and monitoring of the station and connected devices (protection relays)

- Protection relay system (DNP3)
    - Approximately 150 input variables total from several relay devices for monitoring and alarming only
- Remote SCADA (DNP3)
    - Approximately 30 variables for remote control and monitoring

The data to be communicated in each connection is outlined in the IO lists described in Paragraph 8.3.3. Programming will be required to set up and transfer data efficiently across these interfaces.

Tag data transfer between devices should be configured to *read*, rather than *write* data, wherever possible. *Watchdog* supervision alarms should be set up on each connection and an alarm reported to the HMI in the event of lost communication.

The communications scan period should be set to an appropriate length, according to programme requirements, so as not to overload the communications network. Communications scan periods should be shorter than task update times.

The communication protocol is DNP3 over TCP/IP Ethernet. The connections must be configured so that time stamp information is passed correctly between devices and that no data is lost on temporary loss of communications.

9. Specification – HMI Hardware and Software

9.1 Hardware Specification

The HMI (Human Machine Interface) hardware is to be provided under this contract. The following table provides an overview of the hardware components to be provided:

Quantity	Description	Purpose	Location
1	Server computer	HMI Historian Server	Server Cabinet
2	Server computer	HMI Application/Tag Server	Server Cabinet
2	Network Switch	Managed switch for connecting HMI computers to the control network	Server Cabinet
1	Server cabinet	House the Historian and Application servers	Control Room
1	Server computer	HMI Engineering / development	Control Room
4	Desktop PC	HMI client for operator interface	Control Room + Remote locations
2	Desktop printers	Printing trends, events etc.	Control Room
1	Laptop	Maintenance of PLC equipment	-
1	Control desk	For HMI workstations	Control Room
3	Office chairs	For control desk	Control Room

Three of the server computers will be housed inside a server cabinet, supplied by the Contractor and located within the control room. The Engineering server, two desktop client PCs and the printers will be located at the control desk in the control room. The other two client PCs shall be located at remote sites to be advised by the Employer during installation. The maintenance laptops will be used for maintenance work only.

9.1.1 Server Specification

The minimum specification for each of the four server computers listed above is specified in the table below. In addition, the hardware must meet the installed HMI software recommendations to ensure sufficient performance.

Suggested Make / Model	HP Z240 Workstation (or equivalent business grade machine)
Chassis type	Tower
Processor	Intel Core i5 Gen 7 (or superior)
RAM	8 GB (16 GB for Historian)
Hard Drive	1 TB
Operating System	Windows Server 2016
Ethernet network adaptor	1000 MB/s
Number of network adaptors	2

9.1.2 Desktop Client Specification

The minimum specification for each of the four desktop client computers listed above is specified in the table below. In addition, the hardware must meet the installed HMI software recommendations to ensure sufficient performance.

Suggested Make / Model	HP business grade desktop (or equivalent)
Chassis type	Small form factor (SFF)
Processor	Intel Core i5 Gen 7 (or superior)

RAM	8 GB
Hard Drive	500 GB
Graphics	High performance on-board chipset
Ethernet network adaptor	1000 MB/s
Number of network adaptors	1
Operating System	Windows 10 Pro (64 bit)
Monitor	24", 16:9 aspect ratio, 1920 x 1080 screen resolution

9.1.3 Server Cabinet

An industrial rated cabinet is to be provided to house three server computers (1 x Historian and 2 x Application). The cabinet should have a glass front door, provide adequate ventilation and contain shelving for the computer hardware. A slide out shelf shall house a single monitor, keyboard and mouse for accessing the three machines via a hardware extender to switch between machines. The Contractor should propose a suitable solution for this cabinet.

9.1.4 Network Switches

Two managed network switches are to be provided for connection of the HMI Servers and Clients in the control room to the station control network. The switches shall be mounted in the server cabinet.

The two switches will be connected into the redundant ring control network. The HMI servers and workstations shall be connected to each of these switches in a way to provide the greatest redundancy. The switches shall be Schweitzer Engineering Laboratories SEL-2730M, Part No. 2730M0ARAA1112AAAAX0. The switches shall each have dual 110 VDC power supply inputs.

The Contractor shall be responsible for configuring all SEL-2730M managed network switches on the PLC control LAN (including those switches not supplied under this contract). The supplied "Control System Architecture" drawing (W1-CKA-SK01) indicates the number of switches and the location. Note that only one of the two required control room switches are shown on this drawing.

9.1.5 Printers

Two identical desktop printers are to be provided. The printers should be high quality, reputable brand (HP, Canon, Epson, etc.) colour inkjet type, capable of printing on both A3 and A4 size paper. They should have built in wired Ethernet connectivity. Replacement Ink cartridges should be common and readily available in Fiji.

9.1.6 Maintenance Laptop

Two maintenance laptops are to be provided for maintenance of the PLC equipment. The laptops should be of rugged design and suitable for use in a power plant environment. The laptops should include the following minimum features;

Suggested Make / Model	Panasonic Toughbook 54 or Dell Latitude 14 Rugged
Protection (IP) rating	IP51, shock and vibration resistant
Screen size	13" - 14"
Processor	Intel Core i5 / 2.4 GHz
RAM	4 GB minimum
Hard Drive	256 GB Solid State Drive (SSD)
Operating System	Windows 10 Pro (64 bit)
Ethernet network adaptor	1000 MB/s

9.1.7 HMI Hardware Not Included

HMI hardware that is not included in the scope this Contract includes 5 No. panel mounted field clients, one located in each Unit control panel and one at the Intake control panel. These HMI touch screen clients will have the following hardware specification;

- Advantech PPC-4151W-P5AE
- 15" Panel PC,
- Windows 10 (64 bit)
- Rack mounted
- 500GB SSD

Each of these touch screen panels shall have Wonderware client software licenses provided and installed under this Contract.

9.1.8 Control Room Furniture

The Contractor shall furnish a desk and chairs for the control room. The desk shall be sized to comfortably accommodate three Operators, the HMI monitors, keyboards, and mice. Space shall also be included for telephones, note taking and log book entries. Furnish storage for miscellaneous office supplies such as pencils, scissors, tape, paper clips, etc.

The desks shall be constructed of pressboard panels with laminate surfaces and metal frame.

The chairs shall be of fabric and metal construction with a roller base. The chairs shall have an adjustable back rake, and adjustable height chair bottom.

HMI furniture submittal shall be provided for review and approval by the Employer.

9.2 HMI Software Platform

Wonderware System Platform will be implemented as the HMI system at Wailoa power station. This suite of software will be implemented across the hardware specified above as well as the separately supplied touch screen panel clients.

9.2.1 Software Licenses

All *Wonderware* software licenses required for this HMI system are supplied under this contract. The licenses shall be registered in the Employer's name. A 5000 tag license is required for both the Application Server and Historian Server. The necessary drivers required for communication with the specified PLC hardware shall be installed.

The following software licences shall be included along with any other licenses required;

- Runtime and historian client licenses for all Supervisory clients
- Application server license (5000 tag)
- OI Server license (x 2)
- Historian Server license (5000 tag)
- InSight client
- Development Studio 5 year subscription license for the Engineering workstation, purchased upfront
- Microsoft Excel for the Engineering workstation
- Reputable Anti-virus software (full license) installed on all computers
- Any other software and licenses as required for a complete and functional system

Configuration, software and license installation for all HMI computers and hardware, including the hardware not supplied, is part of the scope of this Contract.

Continuous licenses (not requiring renewal) shall be provided for all software, except Development Studio, where a 5 year subscription shall be provided.

9.2.2 Support Contract

The *Invensys Customer First - Standard Level* support contract shall be purchased and registered under the Employer's name. A 5 year subscription shall be purchased upfront as part of this Contract.

9.3 HMI Application Development

9.3.1 Control and Monitoring Screens

Development of the *Wonderware* HMI application is included in the scope of this Contract.

This includes a centralised tag database and graphics screens representing the entire power scheme, including the four generating units, station common services, protection system and intake. The following types of screens shall be included:

- Station overview screen
- Unit overview screens (one for each unit)
- Automatic unit sequence animated display
- Governor and HPU monitoring
- Excitation monitoring
- Control and monitoring for auxiliary equipment
- Generator and turbine capability curves with operating point shown.
- Temperature monitoring
- Vibration Monitoring
- Single line diagrams for switchgear
- Intake monitoring screen
- Communications network status
- Alarms lists – active and historical
- Sequence of Event logging and retrieval
- Trending and retrieval
- Configuration settings

The HMI run time application shall reside on the application servers and will be common for all of the HMI clients.

A navigation bar shall be visible on each screen to allow quick movement between screens with a minimum of commands.

Graphic screens shall be organised by plant / equipment components. Graphic elements shall be sufficiently spaced on the screen, uncluttered, and neatly organised for clarity. Colours shall be selected to promote visibility and to avoid confusion of state. No unnecessary information, including diagrams, pictures or text shall be presented on the screens.

Analogue control variables shall be displayed on a scale object, indicating normal range, high and low alarm limits and full / zero scale of the signal. Where an analogue number is displayed, an appropriate number of decimal places should be used for the quantity being displayed.

The control objects shall allow "Select-then-Confirm" type control of equipment so that commands are not issued by accident. This applies to all control switches and control setpoints. Configuration parameters do not need to be this way.

The following Figures provide a general example of the style and quality of the screens to be provided. These examples are based on the Employers Nadarivatu project that was commissioned in 2013. The Employer can arrange for the Contractor to visit the Nadarivatu project to inspect the control system

installed on request. Note that the examples provided do not constitute the full set of screens required for Wailoa power scheme.

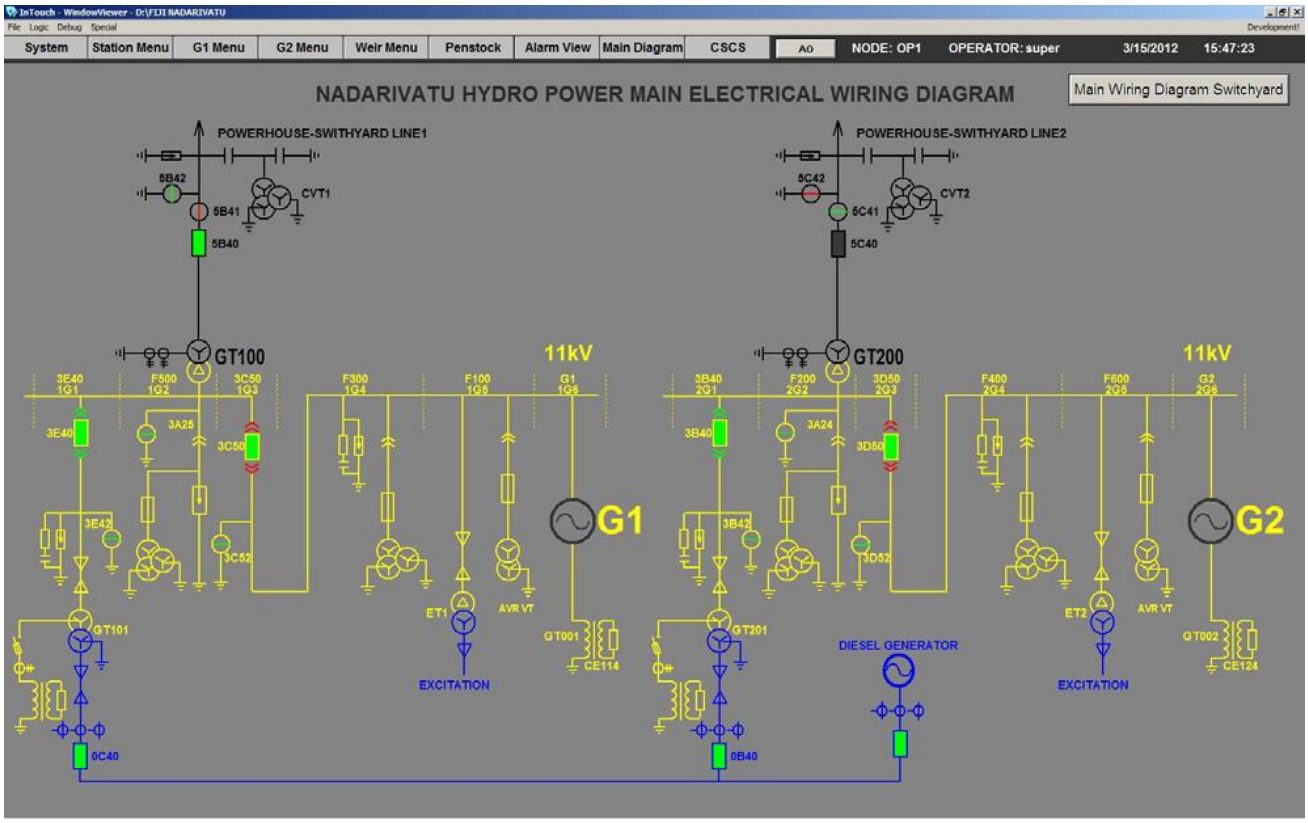


Figure 9-1 Electrical Single Line

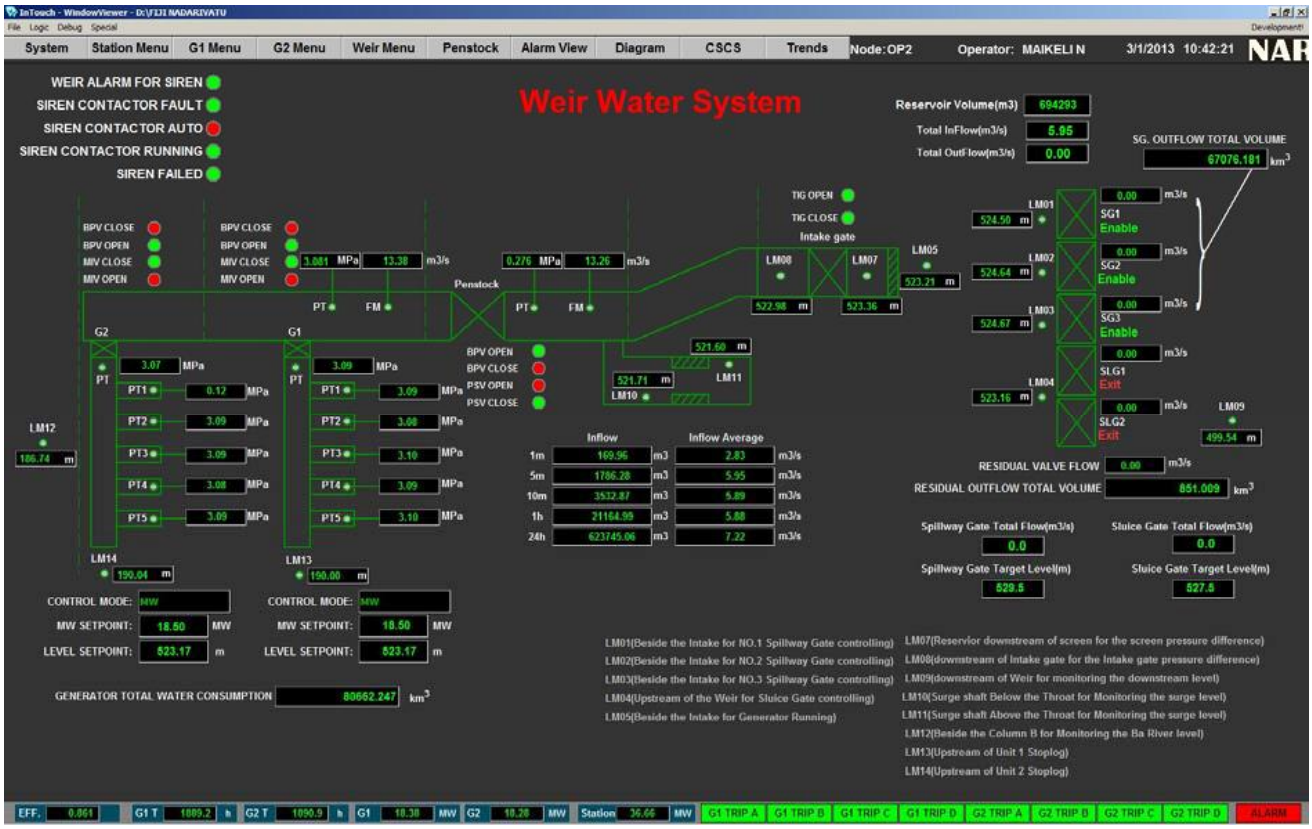


Figure 9-2: Overview of Water Conveyance System

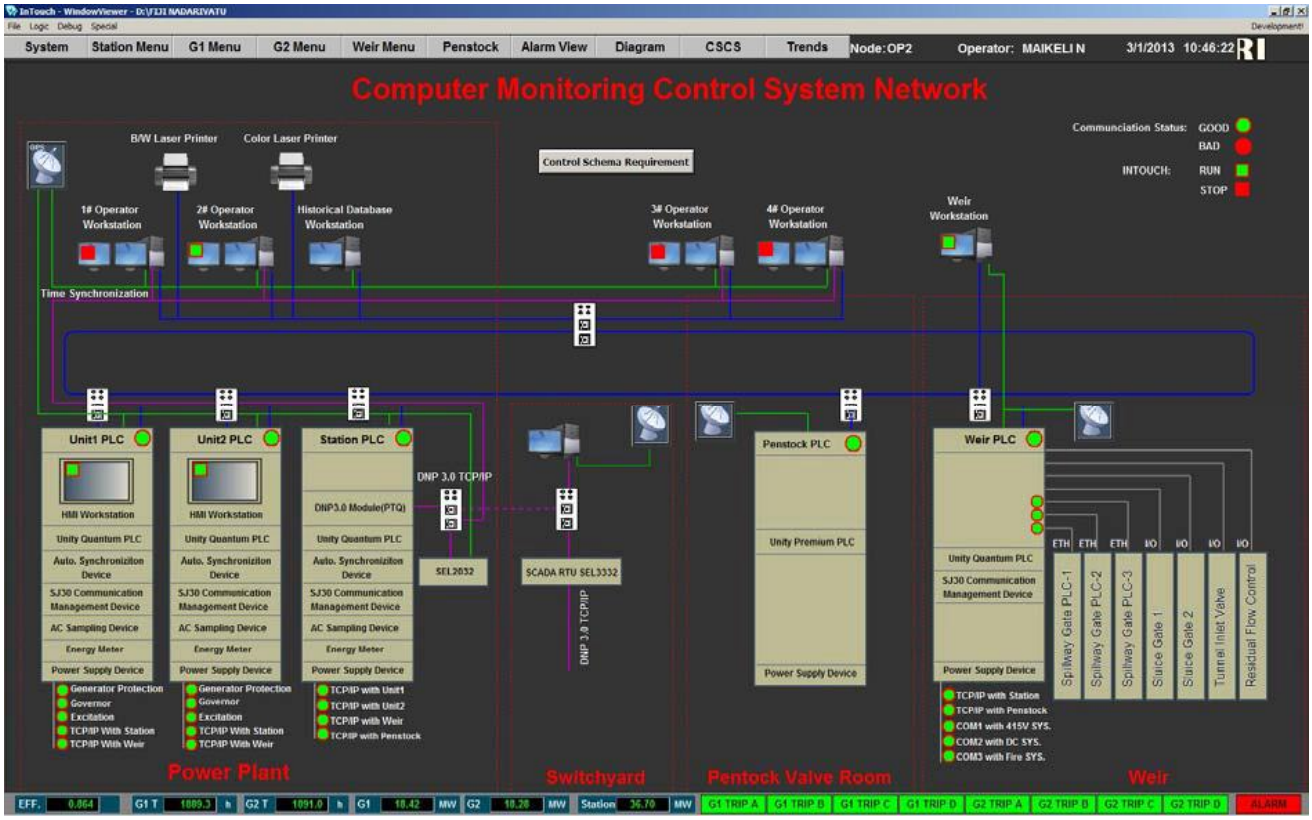


Figure 9-3: Control Network Status

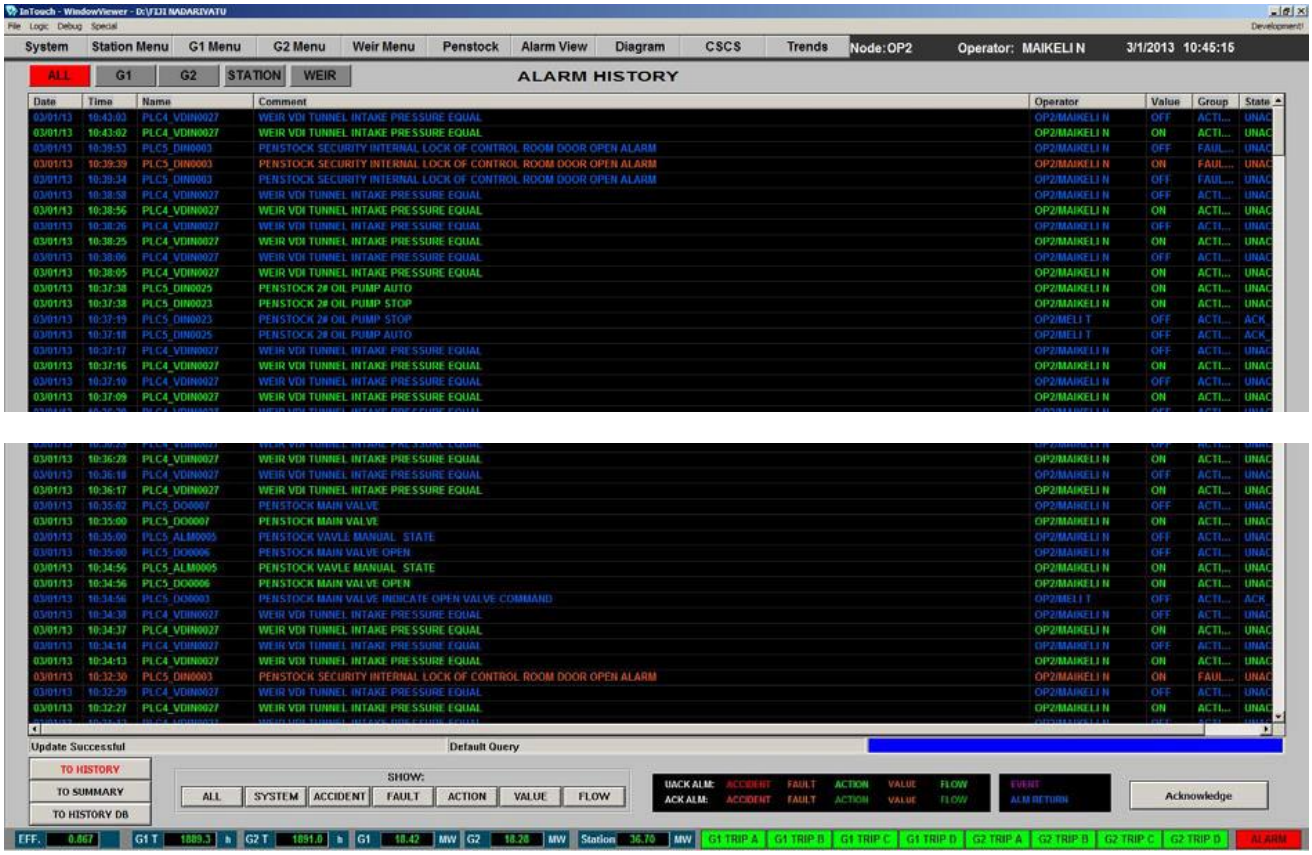


Figure 9-4: Alarm History

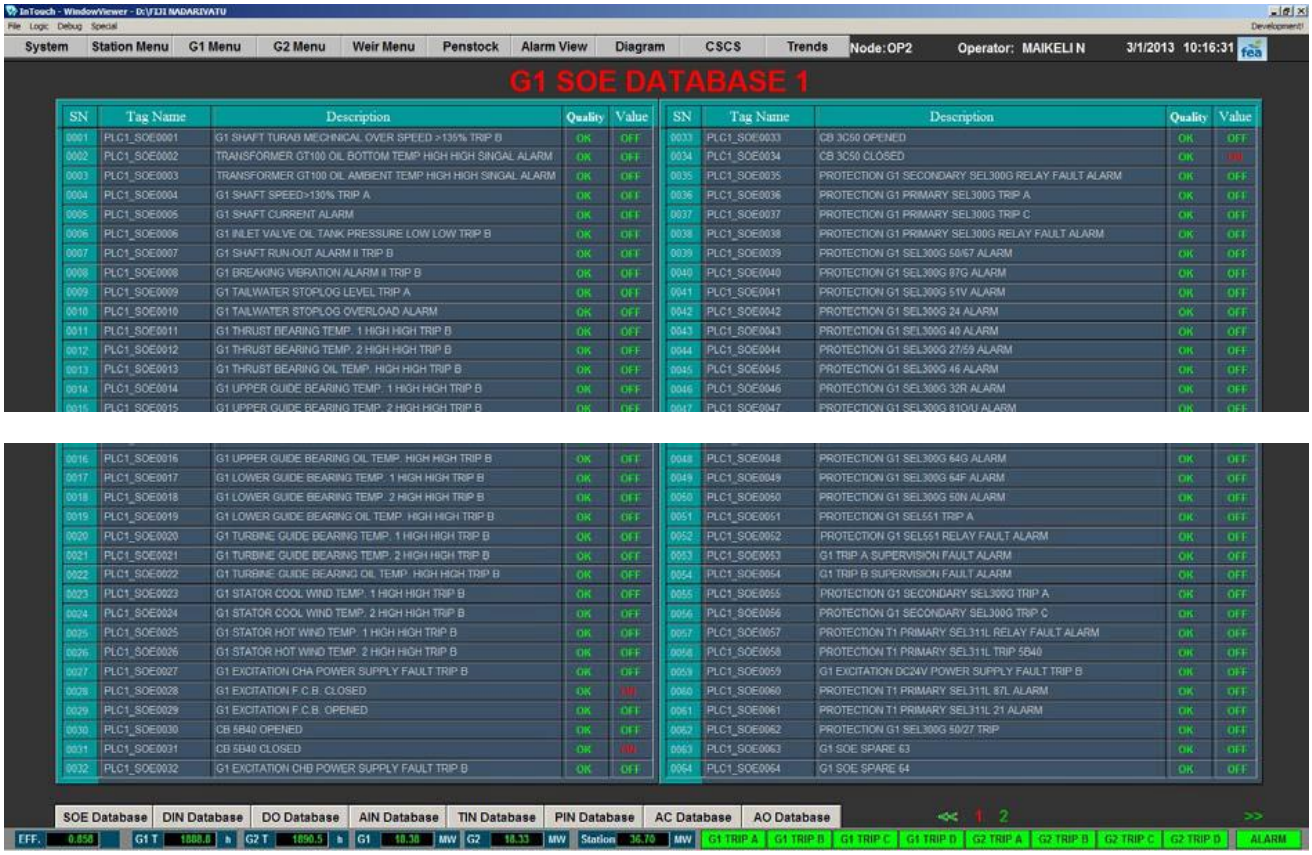


Figure 9-5: Sequence of Events

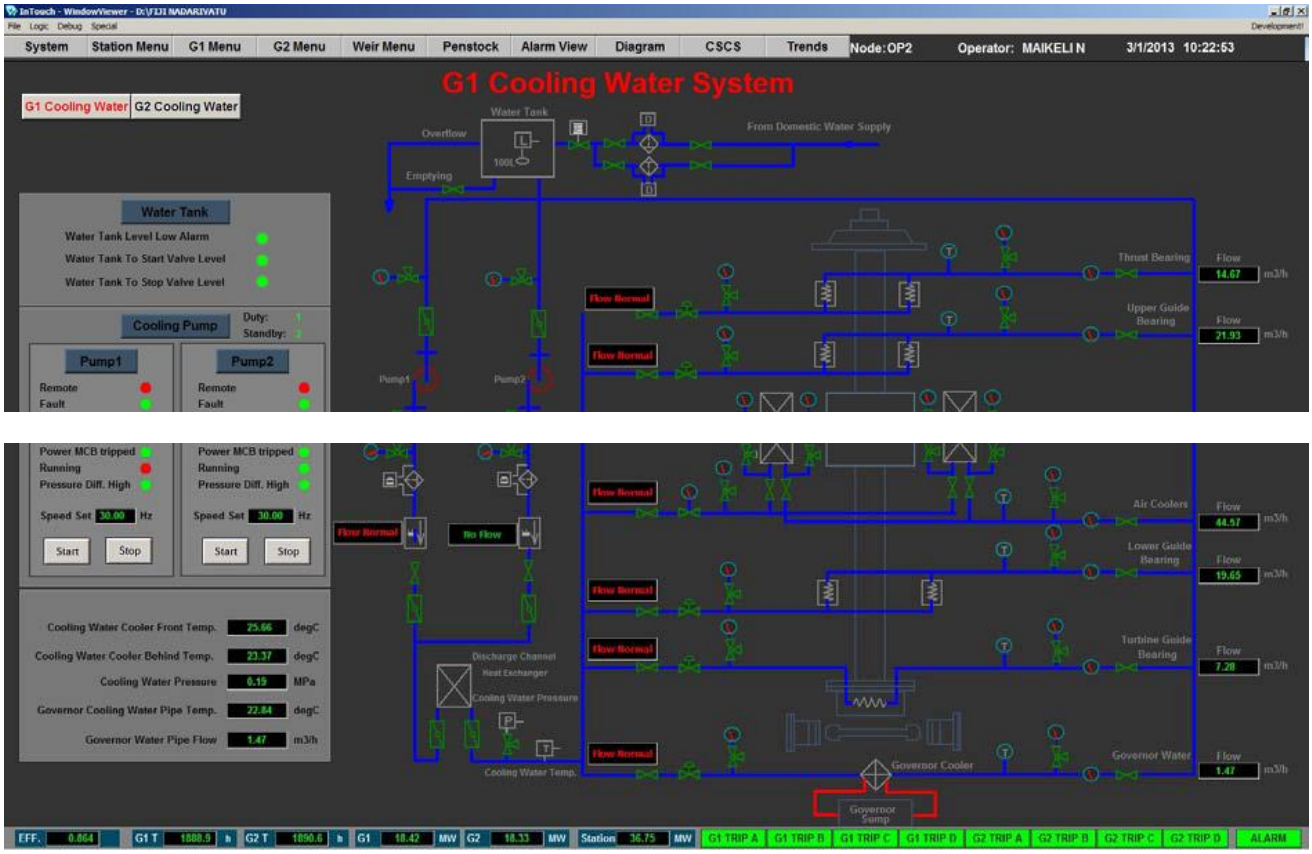


Figure 9-6: Unit Cooling Water System

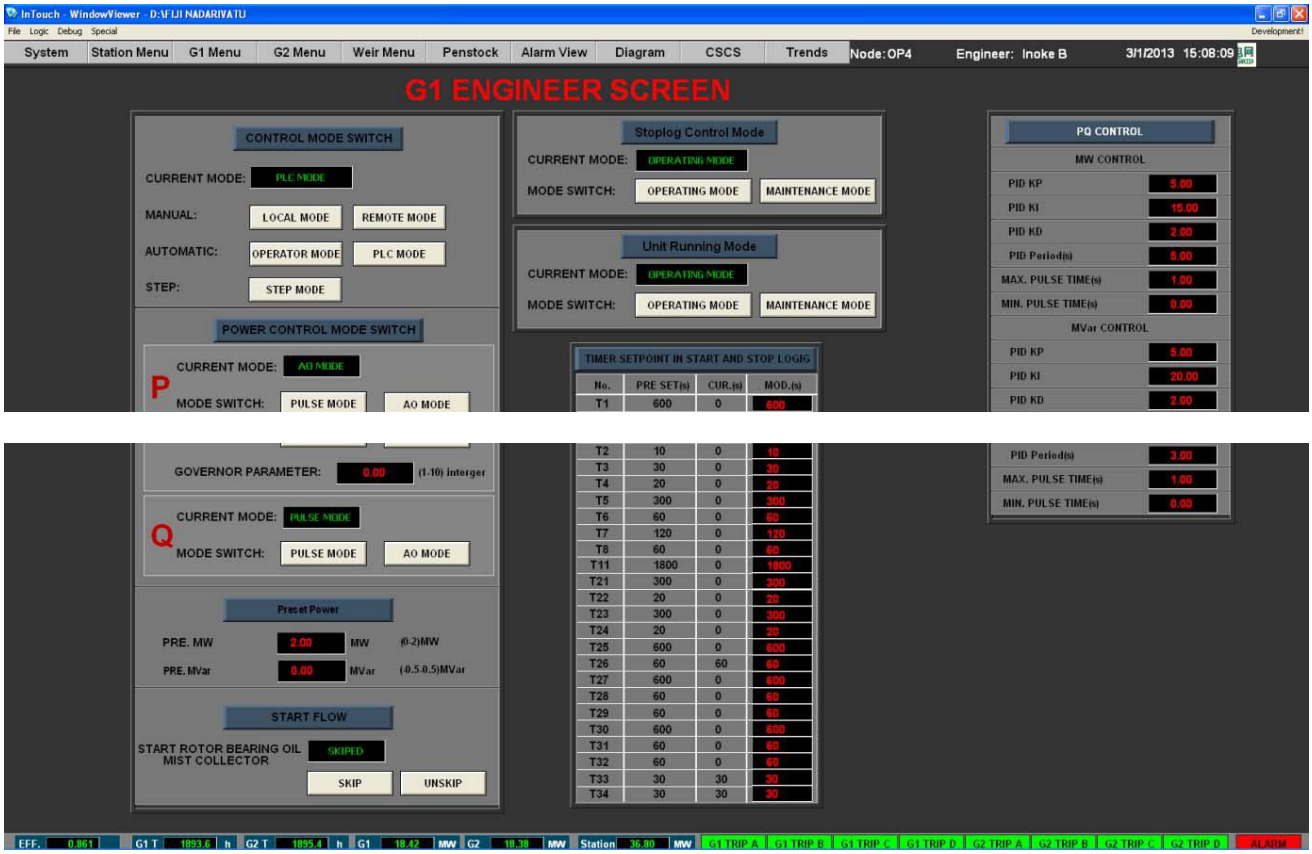


Figure 9-7: Configuration Screen

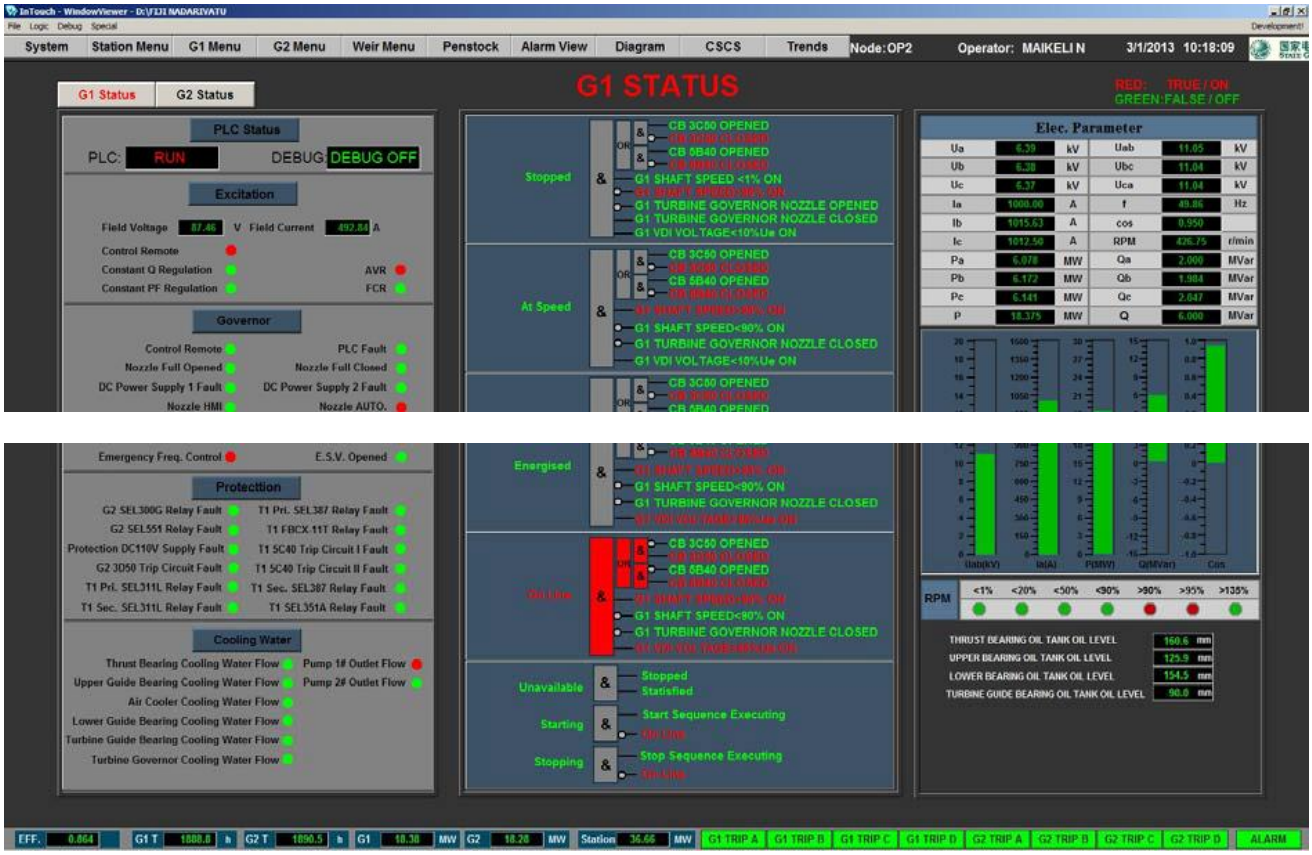


Figure 9-8: Unit Overview Screen

Figure 9-9: Governor Screen

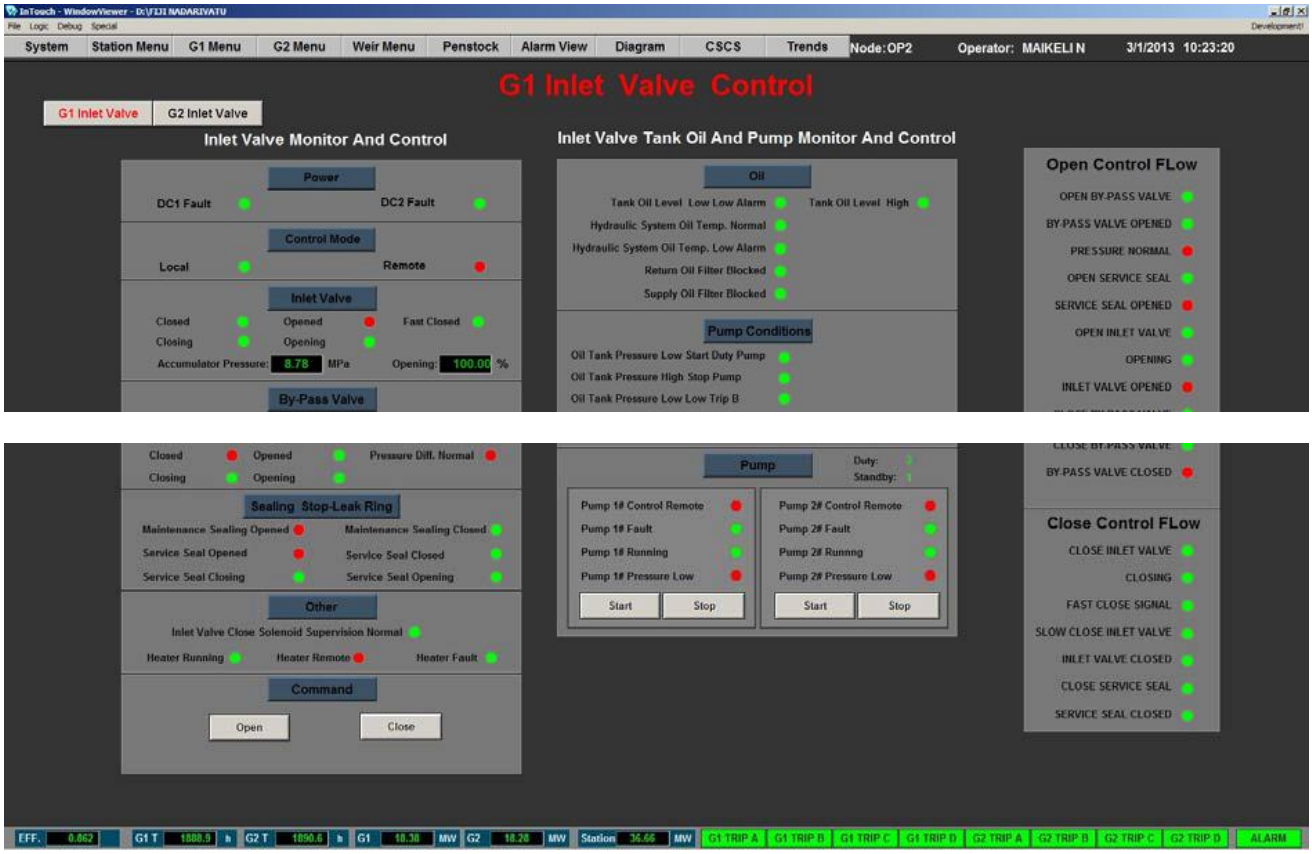


Figure 9-10: Inlet Valve Screen

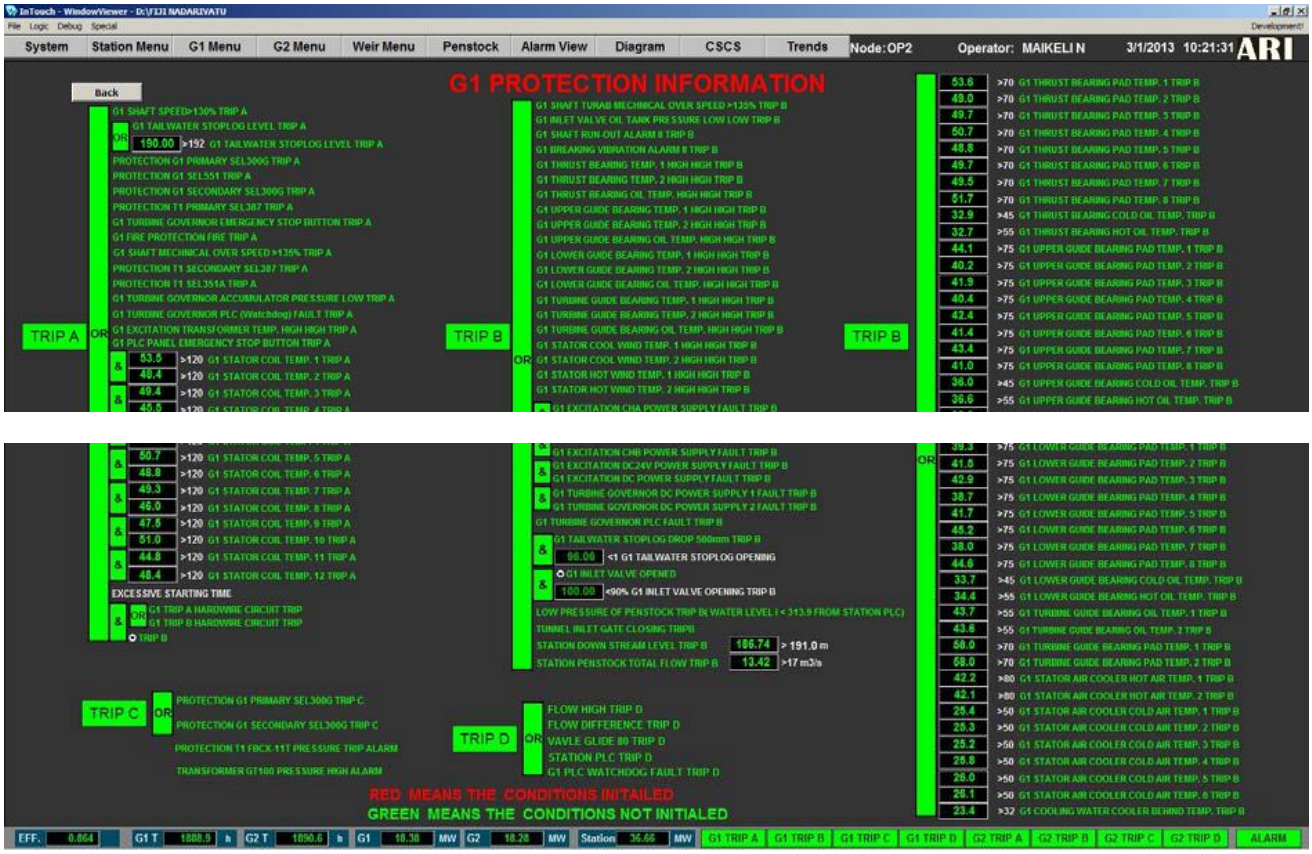


Figure 9-11: Unit Protection Conditions Screen

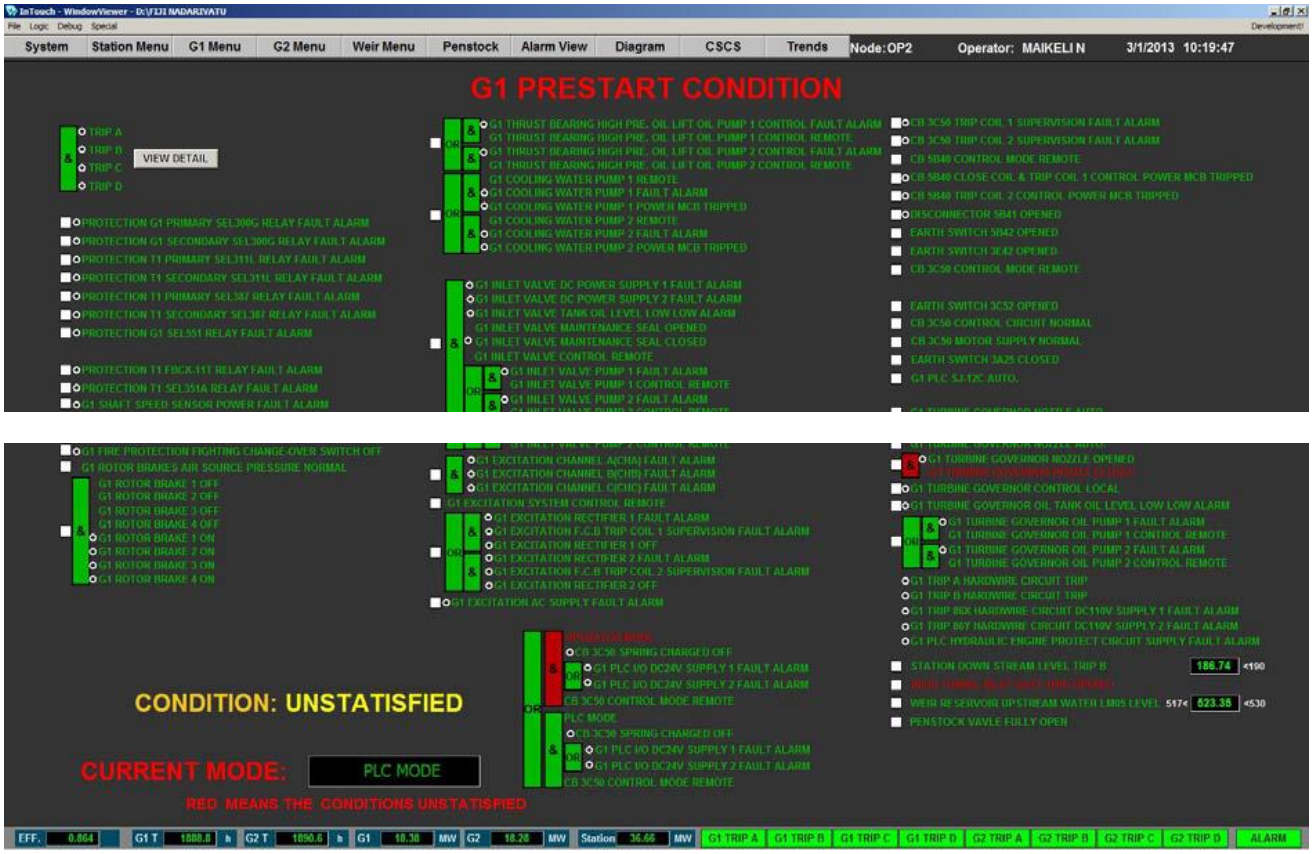


Figure 9-12: Unit Prestart Conditions

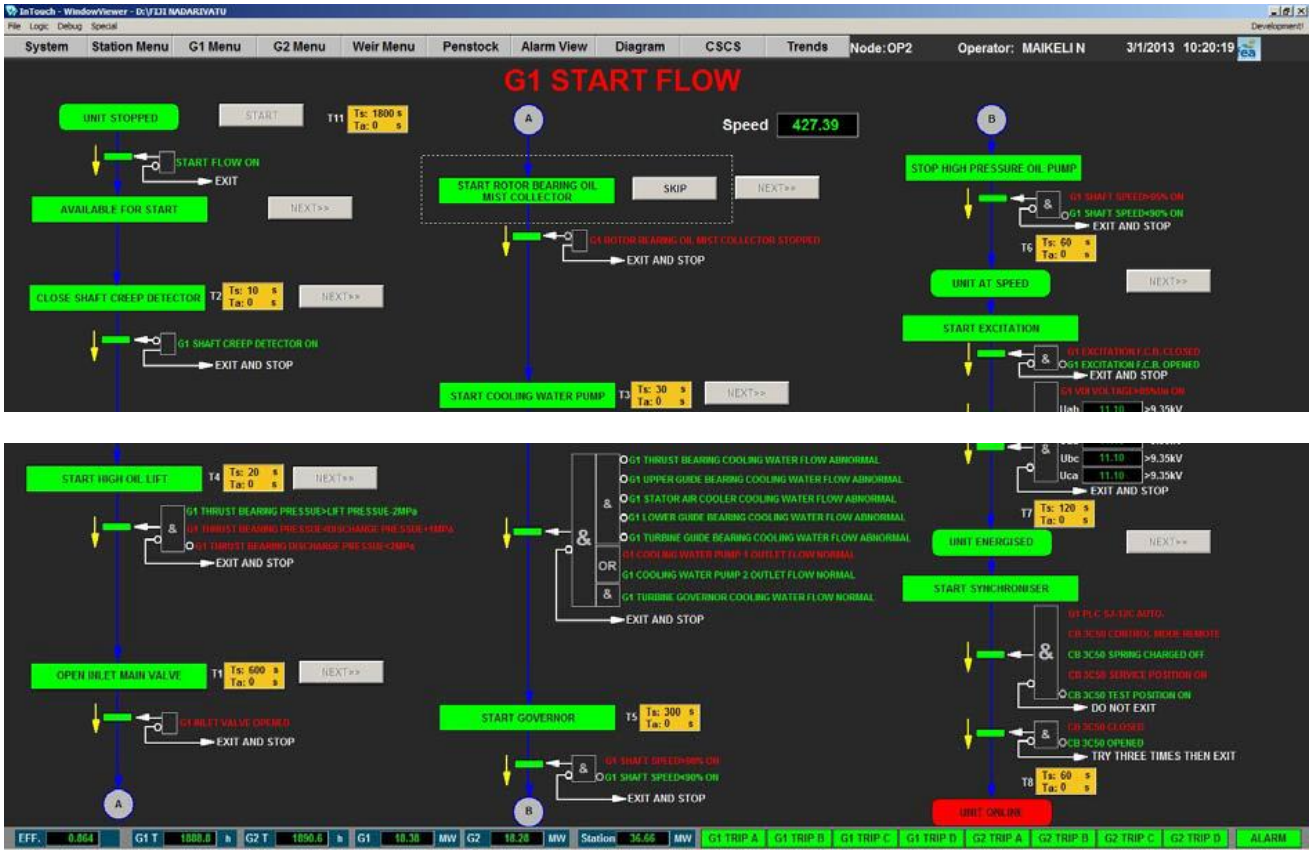


Figure 9-13: Unit Start Sequence

Figure 9-14: Generator Temperature Monitoring Screen

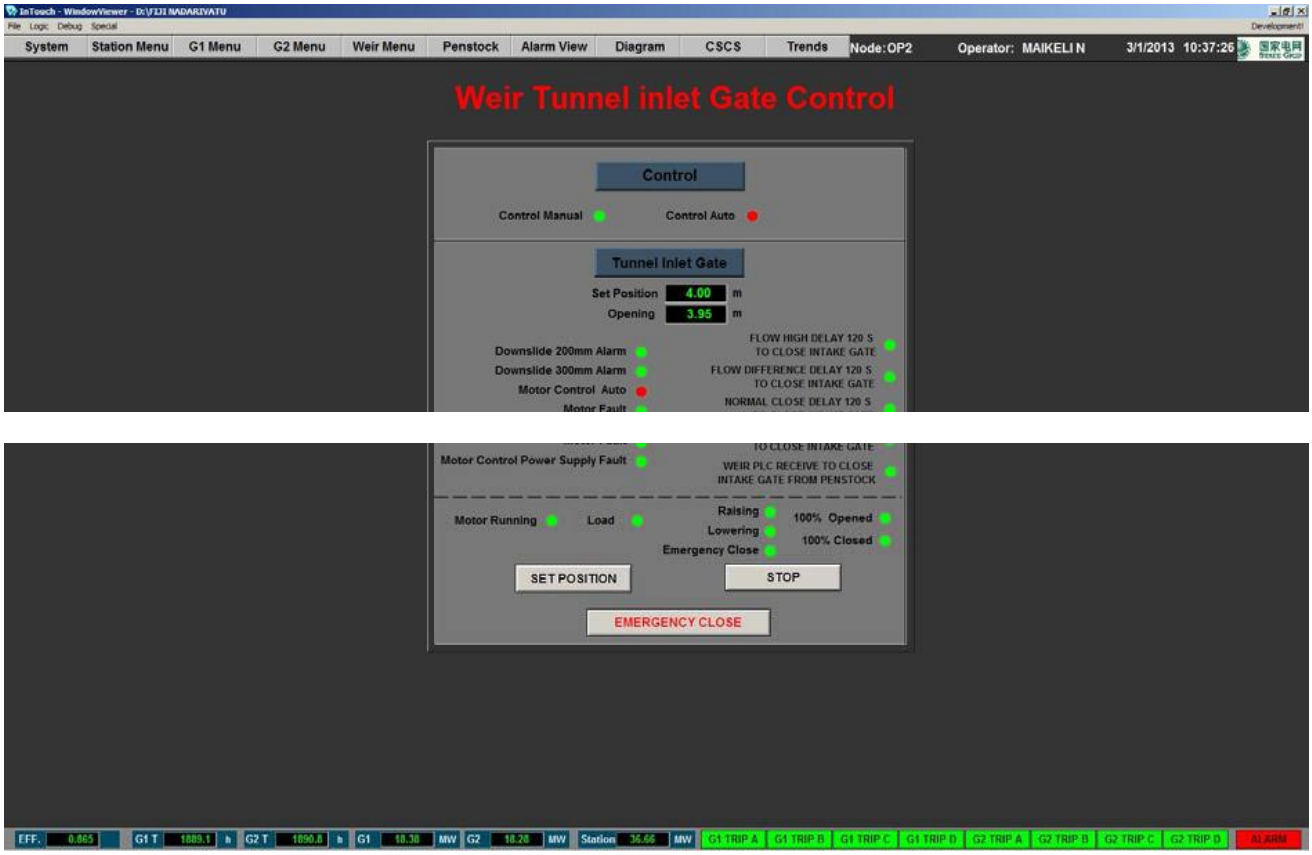


Figure 9-15: Intake Screen

9.3.2 Security Management

The HMI software shall provide a user-based security system. The security system shall allow for the creation of users with certain rights and/or privileges. These rights must include the ability to run any combination of, or all of the applications in the HMI system.

Initially, the security system shall include three levels of access. Viewing only of screens when no log in is entered. Operator log in, allowing full control of the units but no configuration or editing of software. Engineer / Maintenance log in, allowing full access, including changing in configuration settings and editing the HMI screens.

9.3.3 Historical Data Management

Historical Data Management (HDM) software (*Wonderware Historian*) shall be provided for collecting, storing in a SQL relational data base format, and reporting historical operating data of the power plant system. Data shall be collected at periodic intervals and stored in historical files, classified by type.

The HDM shall be capable of collecting and storing a minimum of one year of all digital and analog inputs on hard disk stored at a 5-minute rate for analogs and digitals on change of state with time tag.

The database shall have the ability to handle Sequence of Events (SOE) tags and tags with built in time stamping.

The periodicity of data collection and storage shall be different for each data type and shall be changeable for a specified period at the operator's option.

The storage of collected real-time data in the historical files shall be in the same format as in the HMI database.

The HDM shall be able to perform statistical operations, e.g., maximum, minimum, average over a specific time, etc., on real-time data (process data and calculated data) and storing the results in historical file.

It shall be possible for the user to retrieve sets of data belonging to the same time sample or different time samples through a sort operation or through relational constructs and displays them in tabular form.

It shall be possible to archive historical files on external hard drive for storage and retrieval.

9.3.4 Automated Reports

The HMI system shall include functionality to automatically generate customised reports. The display data for a report, such as generation history, megawatt-hours, running hours, reservoir level, etc. for each individual unit or the station as a whole, shall be configurable by the operator. The data display intervals shall be selectable by the operator, such as hourly, daily, weekly, monthly, etc. The system shall have the ability to save user-defined templates for repeated reports, such as a monthly generation report.

9.3.5 Cyber Security

The control and HMI System shall be protected against unauthorised access and malicious software attacks. Provisions shall include at least:

1. Access to all control and HMI devices items shall use the security provisions provided by the hardware and software OEM vendors (Schneider M580, Unity and Wonderware System Platform) to the maximum extent possible.
2. All default accounts shall be disabled or the associated password changed.
3. Vulnerabilities identified by the hardware and software OEM vendors shall be patched at the earliest opportunity.
4. Remote access shall utilise Multi-Factor Authentication.
5. A firewall or firewalls shall be provided between the Wailoa Control System components and the Employer's other business systems and between the Wailoa Control System and all external communications beyond the power station facility. By default all inbound flows shall be denied. All authorised flows shall be point-to-point.
6. Virtual Private Networks (VPNs) shall be used to force communications between individual PCS items to be via routers.
7. System wide malicious software detection and removal software, fully compatible with the process control software employed, and with automatic updates of the threat identification files.
8. All USB ports, CD-ROM drives and other means of connecting file storage systems to the Wailoa Control System shall be disabled or their functionality limited to prevent the uploading of computer files into the Wailoa Control System by Employer's personnel other than with the appropriate security level.
9. All unused physical ports on switches and routers shall be disabled.
10. Each PLC shall be configured to require a password for connecting (going online) with the PLC for editing using *Unity Pro* software.

10. Factory Testing

Factory testing will be performed in-house by the Contractor to demonstrate the developed software as far as possible. The testing will follow the developed and approved test procedure, submitted according to the project programme (schedule).

A Pre-Factory Acceptance Test (Pre-FAT) shall be performed by the Contractor to verify that the system as fully integrated complies with all of the required functional details and that the system satisfies the response and resource utilization requirements.

The Pre-FAT shall follow completely the test procedures of the FAT Plan reviewed by the Employer.

The Contractor must correct all discrepancies found in the pre-FAT before the Factory Acceptance Test can be started.

The test set up will include as much of the supplied software and hardware as possible, interconnected, so that as many interfaces as possible can be tested and confirmed. Additional test hardware, not supplied under this contract, will be required to complete the testing. This will include networking devices, such as switches and cabling as well as test PLC (or PLC simulation) equipment.

The Employer will loan one complete set of Unit PLC hardware, provided loose, including redundant CPU racks, remote IO racks and all modules residing in these. The hardware will be loaned for the duration necessary to set up and complete the pre-FAT and FAT tests. On conclusion of the FAT, the Contractor shall arrange to ship the PLC hardware back to the employer.

The set up will include the use of;

- Test PLC hardware, loaded with the developed PLC programmes
    - One Unit PLC
    - Common Services PLC (if available)
    - Intake PLC (if available)
- Test software used to simulate field connected equipment of each PLC. The field simulation should be done in hardware external to the PLC programme being tested.
- Test switches and lamps, where applicable and useful (if IO modules available)
- All HMI computer hardware supplied under this Contract, installed with HMI software and applications

The test PLC hardware does not need to include IO modules. Hardwired IO connections with the field equipment simulation can be substituted with a communications link.

Preferably, the same redundant hardware platform would be used for test PLC equipment, but this is not essential if the equipment is not available.

The tests will demonstrate all aspects of the PLC programmes, including unit sequencing, protection trips, mode changes, etc.

The tests will demonstrate the full HMI package with all screens, logging, trending, alarming, access levels, etc.

The Contractor should allow two days for Factory Acceptance Testing (FAT) with the Employer and Engineer in attendance.

Completion of the FAT will require the Employer's signature on the successful test results and the agreed list of discrepancies for the Contractor to attend to before shipment.

11. Installation, Testing and Commissioning

The equipment shall be installed, field tested, and placed in operation by the Contractor. All necessary assistance, tools, and facilities required for the work shall be provided.

The Contractor shall work in coordination with the Engineer, Employer and other contractors.

The Contractor shall provide the level of service during the equipment installation, testing and commissioning as described in the following paragraphs for Sections 2 to 5. The site work for each section will occur according to the project programme. A separate visit to complete the work for each Section is anticipated.

Note that for the purposes of the installation, testing and commissioning phase, a day shall be defined as 12 hours on site.

If additional time on site is required in order to correct issues of the Contractors making, then no additional charges to the Employer will be accepted.

11.1 Installation

The contractor shall set up the HMI hardware in the control room, including the server cabinet and desktop workstations in locations advised by the Employer. Power supply cabling, including 230VAC UPS and 110VDC supplies for the managed switches in the server cabinet, shall be installed and connected by the Employer.

All software, licenses and applications are to be loaded on the HMI hardware, including the five cabinet mounted panel clients, by the Contractor.

Any applicable PLC firmware upgrades, configuration settings, addressing and software downloads are to be performed by the Contractor.

IP addressing for all devices will be set according to a table of static IP addresses provided by the Engineer after Contract Award.

Protection Relay (SEL devices) configuration will be performed by the Employer.

Governor configuration will be by the Turbine Governor Contractor.

Excitation system configuration will be by the Excitation Contractor.

Vibration monitoring system configuration will be by the Generator Contractor.

11.2 Testing

Site testing shall be conducted according to the Site Testing plan developed by the Contractor and approved by the Engineer.

The Contractor will work with the Employer's electrician to systematically liven the control circuits and resolve any instrumentation wiring issues or faults.

Point to point testing of all hardwired IO will be performed by the Contractor under the direction of the Employer. This will be performed once the HMI system is live and running so that signals can be verified from the field through to the operator interface. A list of IO shall be maintained as a commissioning record, with each point signed and dated as it is verified.

All communications interfaces shall be tested and all data types verified to be reading correctly. This includes the remote control interface with FEA's National Control Centre. Where applicable, time stamped data should be checked for correct transfer between devices.

Communications links should be broken to test for detection, alarming and correct failover modes.

The Contractor will work with other contractors, including the Generator, Turbine, Governor and Excitation contractors to test the hardwired and communicated interfaces between the field equipment and the control system.

All raw analogue signals will be scaled to suit the instruments connected and the operating ranges checked as far as possible, i.e. checking full scale and zero scale values.

Correct logging and trending of signals in the Historian shall be verified. Logging shall be confirmed and activated before commission commences so that all commissioning data is recorded.

Alarms shall be tested to ensure they are displayed and recorded correctly.

Each section or routine of PLC software code will be tested as far as possible with the generating unit "dry", in an at-rest state. This will include functional tests of auxiliary equipment, communications interfaces and correct data exchange with all devices. All control actions must be available and initiated via the HMI.

It is imperative that the software is as ready as possible to prevent hold ups during the "Wet testing" phase of commissioning. Successful and timely commissioning of other contracts' work will be depending on the correct functioning of the controls software.

11.3 Commissioning

Re-commissioning of the turbine and generator will be undertaken primarily by the Employer and Engineer with supervision being provided by the various contractors as applicable to their scope of work.

Commissioning of the unit control software will be done in conjunction with the overall commissioning plan for each unit. This will involve working with the Employer, Engineer and a number of other Contractors involved with bringing the unit back into operation.

The entire unit automatic sequence will be tested in stages as equipment in other contracts becomes ready and as directed by the Engineer responsible for commissioning.

At each stage in the sequence, the correct action in case of a trip, operator initiated shutdown or timeout shall be tested.

The controls engineer will need to be present at all times while commissioning is in progress, ready to respond to requests from the commissioning Engineer or other contractor, in case prompt action may be required.

Each protection trip function must be verified separately by a real test, with the correct protective action observed and appropriately logged and presented in the HMI. The results shall be recorded and incorporated into the final commissioning results for each unit.

Changes in online operating modes shall be tested, including governor and excitation control modes. Switching between remote and local control locations should be checked for smooth, "bumpless" transitions.

Screen shots or printouts of the final as-commissioned configuration settings shall be recorded and incorporated into the final commissioning results for each unit.

The overall sequence for re-commissioning each turbine generator will follow the following general structure.

11.3.1 Static Testing

Activity	Responsible Party
Inspection for completeness.	Each Contractor for their work area
Inspection of all the hydraulic conduits and removal of any foreign bodies.	Each Contractor for their work area
Point to point wiring tests.	Each Contractor for their work area
All terminations checked for tightness.	Each Contractor for their work area
Insulation resistance checks on all equipment.	Each Contractor for their work area
2 kV rms power frequency withstand test on all control and protection wiring.	Each Contractor for their work area
High current resistance checks across all high voltage joints (Ductor test).	Each Contractor for their work area
Correct settings applied to all protective devices.	Control system hardware Installation Contractor (not this Contract)

Activity	Responsible Party
Plant control system software SAT tests.	Control system Installation Contractor assisted by each Contractor for their work area. (this Contract)
Measurement of bearing and seal clearance.	Each Contractor for their work area
Hydrostatic tests.	Turbine Contractor
Pressure tests in the governing system, check of oil levels and of the conditions of all oil filters and filtering systems	Turbine Contractor
Pressure tests in the cooling water system.	Generator Contractor
First fill of all lubricating and hydraulic oil.	Turbine Contractor Generator Contractor
First fill of cooling water system.	Generator Contractor
Verification of the correct operation of governor HPU.	Turbine Contractor
Verification of correct operation of HP Oil system.	Generator Contractor
Verification of correct operation of cooling water system.	Generator Contractor
Operational tests of all balance of plant equipment.	Each Contractor for their work area

11.3.2 Pre-Commissioning Tests

The pre-commissioning tests shall include pre-start and closing devices checks:

11.3.2.1 Dry Tests

These tests shall include:

Activity	Responsible Party
Adjustment of dry opening and closing times of turbine needles and deflectors to calculated settings.	Turbine Contractor
Adjustment of dry opening and closing times of main inlet valve to calculated settings.	Turbine Contractor
Confirm that the shutdown circuits function correctly by simulating each and every plant protective trip event and verifying correct operation of the turbine shutdown systems, inlet valve closing systems and generator circuit breaker trip (the generator circuit breaker shall be racked out during these tests).	Control System Installation Contractor assisted by each Contractor for their work area.
Unit Control System start up sequences	Control System Installation Contractor assisted by each Contractor for their work area.

11.3.2.2 Wet Tests

These tests shall include:

Activity	Responsible Party
Verify that the needle leakage is within acceptable limits.	Turbine Contractor

Activity	Responsible Party
Check the opening and closing times for the inlet valve and confirm that they are as expected.	Turbine Contractor
First run operation of the turbine generator. During the first run, the turbine generator shall be "bump started" by manually opening the needles to a small opening for a few seconds. The unit shall be permitted to rotate and observed for any unusual readings, measurements, vibrations or noise.	Turbine Contractor Generator Contractor
Progressively bring the turbine generator up to rated speed using the governor. The turbine generator shall remain at each speed step until such time as the bearing temperatures have stabilised. If any of the turbine generator instrumentation reaches an alarm or trip condition, or exhibits unusual behaviour. At each speed step it shall be verified that the closing devices are functioning correctly: • Verify adjustment for operation of governing system timing at rated speed. • Verify adjustment and measuring accuracy of the speed monitoring systems. • Verify adjustment of the overspeed devices.	Turbine Contractor Generator Contractor Turbine Contractor Generator Contractor Generator Contractor
A bearing heat run at rated speed shall then be conducted. The heat run shall continue for one hour after the bearing temperatures have stabilised. The following parameters shall be recorded during these tests: • Ambient temperature. • Bearing temperatures. • Bearing oil temperatures. • Unit speed.	Generator Contractor assisted by Control System Installation Contractor
At the end of the test the turbine generator shall be shut down by simulating an overspeed event to demonstrate that the emergency shutdown systems are operating correctly.	Control System Installation Contractor

11.3.2.3 Generator Excitation, Protection and Synchronising Tests

Following the successful completion of the heat run the unit shall be started and the following tests conducted:

Activity	Responsible Party
Excite the generator for the first time. Verify that all voltage measurements are being read correctly in the Unit control system and shall undertake excitation system tests as required by the IEC standard and the manufacturer.	Control System Installation Contractor Excitation System Contractor
Test the generator electrical protection as far as possible by reducing settings below the actual measured values and confirming that the protection relays operate correctly.	Control System Installation Contractor

Activity	Responsible Party
With the generator circuit breaker racked out, test synchronising against a dead bus, and verify phase sequence and phase angle between the generator and bus VTs.	Control System Installation Contractor
With the generator racked in and the main power transformer MV open and other generator circuit breaker open, retest synchronising against a dead bus and verify phase sequence and phase angle between generator and bus VTs.	Control System Installation Contractor

11.3.2.4 Overspeed Test

Activity	Responsible Party
Test the overspeed devices by increasing the turbine speed under manual control.	Generator Contractor assisted by Turbine Contractor

11.3.3 Commission Tests

11.3.3.1 First Synchronisation

The Commissioning tests shall commence with a first synchronisation and loading of the turbine generator.

Activity	Responsible Party
Set the governor load limiter to no more than 10% of rated.	Turbine Contractor
The turbine generator shall initially be started, synchronised and loaded (to the 10% limit) using the Unit Control System automatic start controls in 'step by step' manual override mode.	Control System Installation Contractor Assisted by Turbine Contractor and Generator Contractor

The tests shall then be repeated in fully automatic mode.

11.3.3.2 Load Rejection Tests

The turbine generator shall be started, synchronised and the load shall be increased in steps to the maximum value.

Activity	Responsible Party
At each step, observations and measurements in steady state condition shall be repeated and the operating stability of the turbine shall be verified.	Control System Installation Contractor Assisted by Turbine Contractor and Generator Contractor
The turbine generator shall be subjected to load rejection tests at each of the following load steps: 25%, 50%, 75% and 100% of rated load. The load rejection should operate into the turbine ESD controls and a different initiating event should be used for each test.	Control System Installation Contractor Assisted by Turbine Contractor and Generator Contractor
Record the following parameters during these tests: • Penstock pressure. • Spiral case pressure. • Guide vane position. • Turbine generator speed. • Circuit breaker position. • Inlet valve position.	Control System Installation Contractor

11.3.3.3 Generator Heat Run

Activity	Responsible Party
Undertake a generator heat run at rated output. The heat run shall continue for one hour after the winding, cooling system and bearing temperatures have stabilised.	Control System Installation Contractor Assisted by Turbine Contractor and Generator Contractor
Record the following parameters during these tests: • Ambient temperature. • Stator winding temperatures. • Cooling system temperatures. • Turbine discharge water temperature. • Bearing temperatures. • Bearing oil temperatures. • Generator load.	Control System Installation Contractor

11.3.3.4 Trial Operation

Following successful completion of the Commissioning Tests, a Test Run (Trial Operation) shall be performed as required to assure that the equipment has been installed and adjusted properly and that it will function safely and properly under continuous operation. The test run shall be performed in the automatic control mode, without any adjustments or corrections, under certain loads specified by the Employer. The duration of the Test Run shall be for a continuous period (no interruptions allowed) of 720 hours. If the Test Run is interrupted due to malfunction of equipment, the Test Run shall be performed over again.

11.4 Training

The Contractor shall provide fully qualified and experienced representative for training that shall cover the following items:

- Installation
- Operation
- Testing and commissioning
- Maintenance practices for the supplied equipment as recommended by the Manufacturer
- Hands on training on periodic adjustment required, and parts replacement procedure.

It is expected that the Contractor's Commissioning Engineer would perform this training following the Section 2 Taking Over. Four days of training at site should be allowed for to cover two shifts of operators and maintenance staff. This four days is included in the prescribed on-site time for Section 2, as referred to in the Payments section, Paragraph 5.2.2.

Refer to Paragraph 5.4 for further requirements on the training to be provided.

Schedule 1 – Tender Forms

Tender Form 1 – Letter of Tender

Name of Contract: Wailoa Mid-Life Refurbishment Control and HMI Software

Unit Control Software Contract No. MR 286/2017

Tender To: Fiji Electricity Authority
2 Marlow St
Private Mail Bag
Suva
Republic of the Fiji Islands

1. This tender is made by _____
[insert full name and registered address of tenderer].

2. Capitalised terms used in this letter have the meaning given to them in the Instructions to tenderers dated [*insert date*] ("**Instructions**") unless otherwise defined.

3. Having examined and understood the Tender Documents relating to the Works (including the Instructions and all documents attached thereto, including but not limited to the Particular Conditions of Contract, the General Conditions of Contract, the Specification and the Employer's Drawings) we, the undersigned, hereby offer to design, execute, complete and remedy defects in the whole of the Works in conformity with the said documents for the sum of:

…….

……., ($……),

Exclusive of VAT, WHT or such other sum as may be ascertained in accordance with the Contract.

4. This offer is made on the terms and conditions set out in this Tender and the Instructions.

5. We attach the following documents which form part of this tender:

(a) Completed tender forms;

(b) Technical description of the plant offered;

(c) Maintenance contract proposal

(d) Proposed P&IDs – as applicable;

(e) Proposed programme;

(f) Proposed key personnel;

(g) Any supplementary information;

6. We agree to abide by this Tender for a period of 60 days after the Tender Closing Date and that this Tender it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.

7. We confirm that you may rely upon all statements made by us in response to the Instructions or in subsequent correspondence, discussions or negotiations with you.

8. We certify that:

(a) The entry into, and performance of the obligations under, the Contract by us will not violate any laws provided that you obtain all consents and authorisations you are required to obtain under the Contract;

(b) We have corporate power to enter into and perform our obligations under the Contract and we have taken all necessary corporate action to authorise the entry into, and execution of, this offer and (if required) entry into, and execution of, the Contract;

(c) The rates and prices in our offer have been arrived at independently, without consultation or agreement with any other tenderer; and

(d) No attempt has been made, nor will be made, by us to influence any other tenderer to submit or not submit a tender or to alter the proposed content of that tenderer's tender.

9. We acknowledge that this tender, and any contract arising upon its acceptance, shall be governed by and construed in accordance with the laws of The Fiji Islands.

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

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

Dated this _____ day of _____ 2016

Signature _____ in the capacity of _____

duly authorised to sign Tenders for and on behalf of: _____

Witness _____

Address _____

Occupation _____

Tender Form 2 – Tender Price and Breakdown

Item	Amount Fijian Dollars (FJD) Excluding VAT	Amount Foreign Currency (Nominated by Tenderer
Section 1 Offshore Work		
Unit PLC programme development		
Intake PLC programme development		
Common PLC programme development		
Complete HMI application development		
Server cabinet (incl. hardware extender, monitor, keyboard, mouse, etc)		
SEL2730M managed switch (2 No.)		
Server computers (4 No.)		
Workstation PCs (4 No.)		
Maintenance laptops (2 No.)		
Printers (2 No.)		
Control desk and 3 office chairs		
Wonderware Historian Server 5K Tag software licence (1 no.)		
Wonderware Application Server 5K Tag and OI Server (2 No.)		
Wonderware Supervisory Client w/ HistClient software licenses (9 No.)		
Wonderware Development Studio license (5 year contract) (1 No.)		
Wonderware support contract, Invensys Customer First - Standard Level (5 year subscription)		
Schneider Unity V12 Pro L software licenses (3 No.)		
Microsoft Excel license		
Anti-virus software license for all computers (13 No.)		
Testing and commissioning plans		
Factory acceptance testing		
Completed test reports		
O&M manual		
Delivery to site		
Section 1 Sub-Total		

Onshore work	Section 2 (Total 80 man-days)	Section 3 (Total 50 man-days)	Section 4 (Total 50 man-days)	Section 5 (Total 60 man-days)
Person 1 role description				
Person 1 round trip travel to Fiji (Fijian Dollars (FJD) excluding VAT)				
Person 1 number of days				
Person 1 daily rate (Fijian Dollars (FJD) excluding VAT)				
Person 1 disbursements per day (Fijian Dollars (FJD) excluding VAT)				
Person 1 total cost (Fijian Dollars (FJD) excluding VAT)				
Person 2 role description				
Person 2 round trip travel to Fiji (Fijian Dollars (FJD) excluding VAT)				
Person 2 number of days				
Person 2 daily rate (Fijian Dollars (FJD) excluding VAT)				
Person 2 disbursements per day (Fijian Dollars (FJD) excluding VAT)				
Person 2 total cost (Fijian Dollars (FJD) excluding VAT)				
Person 3 role description				
Person 3 round trip travel to Fiji (Fijian Dollars (FJD) excluding VAT)				
Person 3 number of days				
Person 3 daily rate (Fijian Dollars (FJD) excluding VAT)				
Person 3 disbursements per day (Fijian Dollars (FJD) excluding VAT)				
Person 3 total cost (Fijian Dollars (FJD) excluding VAT)				
List of other expenses (travel, accommodation, food, etc.) (Fijian Dollars (FJD) excluding VAT)				
Section Sub-Total (Fijian Dollars (FJD) excluding VAT)				

Note that a maximum of 8 days of continuous site work shall be permitted for any individual before a full day off is required.

Tender Price Summary	Amount Fijian Dollars (FJD) excluding VAT	Amount Foreign Currency (Nominated by Tenderer)
Section 1		
Section 2		
Section 3		
Section 4		
Section 5		
Total Tendered Price		

Optional Prices	Amount Fijian Dollars (FJD) excluding VAT	Amount Foreign Currency (Nominated by Tenderer)
Optional spare parts (list in detail)		
Total		

Signature .....

Name .....

Position .....

Company .....

.....

Address .....

.....

Date .....

Tender Form 3 – Proposed Key Personnel

Contract Manager:	.....
Site Works Supervisor:	.....
Commissioning Engineer:	.....

Signature	.....
Name	.....
Position	.....
Company	.....
	.....
Address	.....
	.....
Date	.....

Tender Form 4 – Proposed Suppliers and Sub-Contractors

	.....
	.....
	.....
	.....

Signature	.....
Name	.....
Position	.....
Company	.....
	.....
Address	.....
	.....
Date	.....

Tender Form 5 – Schedule of Hourly Rates

Personnel	Basic Hourly Rate On Site (State Currency) ($/h excluding GST and WHT)
Contractor Manager:	.....
Lead Design Engineer:	.....
Controls Engineer:	.....
Programmer:	.....
Commissioning Engineer:	.....

Hourly rates apply up to a maximum of 12 hours worked in any one day.

A maximum of 8 days of continuous site work shall be permitted for any individual before a full day off is required.

Tender shall specify any special factors applicable to adjust the basic hourly rates for work on weekends and public holidays.
Weekend factor .....
Public holiday factor .....

Explanatory Notes
(a) The Tenderer shall complete the Schedule of Hourly Rates tender form to show the basic hourly rates applicable for any authorised extra work on the site.
(b) The Schedule will be used as a basis for evaluating tenders and as a basis for agreeing cost for any extra authorised work.
(c) The basic hourly rate shall include all overheads, profit, hand tools and allowances and shall represent the total cost to the Employer for personnel employed during normal working hours. The rates shall be exclusive of GST.
(d) The scheduled hourly rates shall be applicable throughout the course of the works.
(e) Time sheet records shall be supplied by the Contractor as a basis for agreeing costs for any extra work.

Signature .....
Name .....
Position .....
Company .....
.....
Address .....
.....
Date .....

Tender Form 6 – Percentage On-Costs

Item	Description	Percentage on Cost
1.	Equipment and materials supplied on cost plus basis (including transport)	.....
2.	Sub-contractors employed on cost plus basis	.....
3.	Equipment hire	.....
4.	Contractor's profit	.....

Explanatory Notes

(a) The Tenderer shall complete the Percentage on Costs form to show the percentage on cost applicable for supplying extra equipment and materials, employing extra Sub-contractors on a cost plus basis and for arranging extra equipment hire.
(b) The percentage on costs shall allow for all costs incurred by and profits for the Contractor in arranging for the supply of any extra equipment and materials or hire of any extra equipment.
(c) The percentage on costs shall allow for all costs incurred by and profits for the Contractor in arranging and managing any extra Sub-contractors employed on the job.
(d) Invoices shall be supplied by the Contractor to substantiate any claim for costs associated with work performed on a cost plus basis.
(e) The percentage on costs and invoices will be used as a basis for agreeing costs associated with any variations to the contract.

Signature .....
Name .....
Position .....
Company .....
.....
Address .....
.....
Date .....

Tender Form 7 – Statement of Conformance

We have read and understood the Tender documentation for the generator rehabilitation contract, and confirm that:

Tick 1 Box as Applicable

☐ Our Tender is in full compliance with the requirements and we have no exceptions to note.

☐ Our Tender does not fully comply with the requirements. The following exceptions apply:

.....

.....

.....

.....

.....

.....

.....

.....

Signature .....

Name .....

Position .....

Company .....

.....

Address .....

.....

Date .....

Tender Form 8 – Proposed HMI Hardware and Software Licenses

Server Computers	
Number of computers supplied	
Make / Model	
Chassis type	
Processor	
RAM	
Hard Drive	
Operating System	
Ethernet network adaptor speed	
Number of network adaptors installed in each server	
Desktop Client PCs	
Number of PCs supplied	
Make / Model	
Chassis type	
Processor	
RAM	
Hard Drive	
Graphics	
Ethernet network adaptor speed	
Operating System	
Monitor - Make, Size, Resolution	
Maintenance Laptop	
Number of laptops supplied	
Make / Model	
Protection (IP) rating	
Screen size	
Processor	
RAM	
Hard Drive	
Operating System	
Ethernet network adaptor	
Colour Inkjet Printers	
Number of printers supplied	
Make / Model	
Control Desk	

Desk Make/ Model	
Desk Dimensions (L x W x H)	
Office Chair Make/ Model	
Number of chairs supplied	
Network Switches	
Number of Switches supplied	
Make	
Power Supply Voltage	
Model Number	
Software Licenses	
Server package license descriptions and Wonderware part number	
Number of Historian Server node licenses supplied	
Number of Application Server node licenses supplied	
Supervisory Client license descriptions and Wonderware part number	
Number of Supervisory Client node licenses supplied	
Development Studio Subscription license – number of years of contract supplied	
5 year Invensys support contract included?	
Number of Microsoft Excel licenses supplied	
Schneider Unity Pro license description	
Number of Unity Pro licenses supplied	
Anti-virus software description	
Number of anti-virus software licenses supplied	
Description of other software licenses supplied	

Schedule 2 – Form of Contract Agreement

This Agreement is made this day of 2017

Between The Fiji Electricity Authority,
(Herein called the Employer)

And ,
(Herein called the Contractor)

Whereas

A. The Employer requires that certain Works be provided and executed by the Contractor set out in clause 2 below, the Works being more particularly defined in the Contract documents:
B. The Contractor has submitted a Tender to the Employer for the provision and execution of the Works by the Contractor for the sum of FJ$_____ plus FX$_____ (foreign Currency to be nominated at time of tender) (the Contract Price) and the Employer has accepted such Tender:
C. The Employer has appointed Mr Robin Spittle to be the Engineer for the purpose of the Works:

NOW THEREFORE the parties are agreed as follows:

1. In this Contract Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement:

   - Contract Agreement
   - The Letter of Acceptance
   - Appendix to Tender
   - The completed Tender Schedules
   - Notice to Tenderers (NTT)
   - Particular Conditions of Contract
   - General Conditions of Contract
   - Specifications (with Section 3 taking precedence over Section 4)
   - Letter of Tender
   - Contractor's Proposal
   - Instructions to Tenderers.

   Should there be any ambiguity or discrepancy between these documents the documents shall take precedence in the order of priority listed above.
3. In consideration of the payments to be made by the Employer to the Contractor in accordance with the Contract, the Contractor shall design, execute and complete the Works and remedy defects therein in conformity in all respects with the provisions of the Contract.

4. The Employer shall pay the Contractor in consideration of the design, execution and completion of the Works and the remedying of defects therein the Contract Price or such other sum as may come payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
5. The parties have entered into this Agreement in accordance with their respective laws and statutes or constitutions on the date hereof by their fully authorised signatories.

Binding signature on behalf of the Employer Title: .....
..... Dated: .....

Binding signature on behalf of the Contractor Title: .....
..... Dated: .....

Appendices

Appendix A Control System Architecture Drawings

Appendix B Unit PLC Functional Descriptions

Appendix C Unit PLC IO Schedule

Appendix D Nadarivatu Operating and Maintenance Manual

Tender Submission - Instruction to bidders

It is mandatory for Bidders to upload a copy of their bid in the **TENDER LINK** Electronic Tender Box no later than **4:00pm, on Wednesday 29th November, 2017**

To register your interest and tender a response, view 'Current Tenders' at: **https://www.tenderlink.com/fea**

For further information contact The Secretary Tender Committee, by e-mail **TDelairewa@fea.com.fj**

In additional, hard copies of the tender, one original and one copy must be deposited in the tender box located at the FEA Head Office, 2 Marlow Street, Suva, Fiji no later than **4:00pm, on Wednesday 29th November, 2017-** Addressed as

Tender – MR 286/2017 Wailoa Mid-Life Refurbishment Control & HMI Software

The Secretary Tender Committee

Fiji Electricity Authority

Head Office

Suva

Fiji

- **Hard copies of the Tender bid will also be accepted after the closing date and time provided a soft copy is uploaded in the e-Tender Box and it is dispatched before the closing date and time.**

Tenders received after **4:00pm** on the closing date of **Wednesday 29th November, 2017.**

- will not be considered.
- Lowest bid will not necessarily be accepted as successful bid
- **It is the responsibility of the bidder to pay courier chargers and all other cost associated with the delivery of the hard copy of the Tender submission including any Duties/Taxes. Hard copies of the Tender submission via Post Box will not be considered.**

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