HESSEQUA MUNICIPALITY

HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :
MECHANICAL AND ELECTRICAL WORKS

PART C3 : SCOPE OF WORKS

C3.1 **Project Data**

C3.2 **Mechanical Specifications**

Mechanical Standard Specifications

C3.3 **Electrical Specifications**

Electrical Standard Specifications

C3.4 **Annexures**

HESSEQUA MUNICIPALITY

HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :

MECHANICAL AND ELECTRICAL WORKS

PART C3.1: PROJECT DATA

CONTENTS

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PD1 DESCRIPTION OF THE WORKS

PD1.1 Employer's objectives

Hessequa Municipality intends to refurbish the Albertinia Waste Water Treatment Works. The original inlet works and irrigation pump station do not meet the expectations of the employer and have to be refurbished.

A civil contractor has been appointed under different contract and will construct a new inlet works, upgrade the existing screened raw waste water pump sump and will construct a new irrigation dam and irrigation pump station.

The capacity of the present Works is 700 kℓ/d and it will remain the same even after the refurbishment. It is foreseen that in the future the Works may have to be upgraded to 2 100 kℓ/d.

This Contract covers the provision of mechanical and electrical components to the new inlet works i.e. screens, pumps, etc as well as pumps to the new irrigation pump station.

PD1.2 Extent of the Works

Scope of Work (Mechanical and Electrical)

The Mechanical scope to be included in this Mechanical and Electrical Contract comprises the design, supply, delivery, installation, testing and commissioning of:

a) Inlet Works: One new mechanical front raked screen including all associated equipment, piping, valves and washer compactor.
One new hand raked screen complete with handrake.
b) Screened raw waste water pump station : Two new self-priming centrifugal pumps including all associated equipment, piping, valves, level controls, etc.
c) Two new mixers including anchoring brackets and all associated equipment and hoists.
d) Irrigation pump station : Two new centrifugal borehole pumps including all associated equipment, piping, valves, level control, etc.
e) General:
- Provision of pipework, chutes and instrumentation
- Provision of anchoring and all other equipment required to complete Works

The Electrical scope to be included in this Mechanical and Electrical Contract comprises the installation of the following:

a) Installation of a new 150kVA generator to supply the standby power requirements for the plant
b) LV cables, cable ladders and conduits to all motors and equipment
c) Distribution boards for selected small power and lighting
d) Earthing for all components
e) Labelling for all equipment and cables
f) Testing and commissioning of the electrical installation
g) Provision of emergency genset
h) Operation and Maintenance Manuals

The Instrumentation and Control scope to be included in this Mechanical and Electrical Contract comprises the installation of the following:

a) LV Switchgear and control gear assemblies including VSDs, Soft Starters and all weather MCC panels and PLC's / HMI's.

b) Upgrading and integration of PLC and SCADA system (Provisional)
c) Incorporation of the new equipment onto the existing telemetry system (Provisional)
d) Instrumentation and control
e) Earthing of all instrumentation and control components
f) Labelling of all instrumentation and control equipment and cables
g) Testing and commissioning of the Instrumentation and Control installation
h) Operation and Maintenance Manuals

This description of the Mechanical and Electrical Works is not necessarily complete and the above list shall not limit the work to be carried out under this Contract.

Further to the above, the scope also includes:

- Training of Employer's staff in operation and maintenance
- Trial Operation period
- Upholding during the Defects Notification Period.

PD1.3 Location of the works and access

The site is located at the Albertinia Waste Water Treatment Works. The works are accessible by means of internal streets and access road to the Works. It shall be kept in mind that the work will be carried out on an active waste water treatment works.

Installation of screened raw waste water pumps and mixers will occur in the pump sump while it is in operation.

The Contractor shall be aware of this situation and allow for all additional cost due to the fact that flows cannot be diverted or stopped. Pumps may be switched off for short periods of time only. In order to avoid flows work may have to be carried out in off peak hours i.e. between 24h00 and 05h00 when flow will be at its lowest.

The Contractor shall at all times provide safe access to the process controllers and the Municipal staff at the works.

Similarly vacuum tankers and municipal vehicles will be allowed free access and usage of the Works at all times.

Any restrictions to the emptying of vacuum tankers, temporary stopping of pump stations, restrictions to access etc. shall be arranged between the Contractor and the Municipal officials responsible for the operation of the Works.

PD2 ENGINEERING

PD2.1 Drawings issued with this document

The drawings applicable to the Contract are issued with this tender document and will form part of the Contract Documents.

PD2.2 Contractor's Documents to be submitted for Approval

PD2.2.1 General Requirements

The Contractor's Documents shall comply with the following general requirements:

1) Three hard copies of all documents shall be submitted, unless prior approval to submit soft (PDF) copies is given by the Engineer.

2) A register of all the Contractor's drawings and documents shall be provided with each submission.

3) Drawings shall be prepared in accordance with the latest issue of SANS 10111. An equivalent international code of engineering drawing practice will also be acceptable.

4) General Arrangement drawings shall be to A1 size or larger and shall incorporate the following:

   a) One plan and two side elevations, sufficient additional sections shall be included to clearly show the arrangement of all plant and equipment

   b) Item lists shall be provided on the drawing or on a separate parts list

   c) Layout Dimensions

   d) A descriptive drawing title

5) Drawings shall be to scale, with both the scale and the drawing being large enough to clearly show all relevant components of the plant and equipment.

6) Item descriptions shall include the material of construction, quantity and full identification information, including, as applicable, brand name, manufacturer's reference number, model number, size, rating, source, duty, quantity, etc.

7) Requirements for building and civil details to be provided by others and shall be specifically noted.

8) The date by which possession of the Site can be handed over to the Contractor and consequently the completion date of the Works, is dependent on the date of submission and acceptance of the documents referred to below, and also dependent on Clause PD4.1 in Part PD4 (Management). Costs resulting from delays in submission of the Contractor's Documents or in correcting errors or making changes on documents not approved by the Engineer shall be for the Contractor's account

PD2.2.2 ***Required Submissions within 14 days***

The Contractor shall submit the following for acceptance within 14 working days from the Commencement Date:

1) Programme for The Works in Gantt chart format, including submission dates for Contractor's documents

2) Health and Safety Plan for approval by the Client's appointed Health and Safety Responsible Person

3) Marked up civil Drawings with revised dimensions

4) Hazop Study Report

5) Signage Design

PD2.2.3 ***Required Submissions within 42 days***

The Contractor shall submit the following **General Documents** for acceptance within 42 days from the Commencement Date:

1) Updated Contractor's drawing and document register

2) Quality Control Plans for equipment

3) Contents list for the Operation and Maintenance Manual

4) Control system specifications

The Contractor shall submit the following **Mechanical Documents** for acceptance within 42 days from the Commencement Date and shall include the following (if applicable) as a minimum:

1) Data sheets for all items of equipment giving performance, sizing, physical and general technical data.

2) Baseplate design.

3) Equipment list with the make and model of all proposed items.

4) Motor and Equipment List

The Contractor shall submit the following **Electrical and Control & Instrumentation** Documents for acceptance within 42 days from the Commencement Date and shall include the following (if applicable) as a minimum:

1) LV Installation

   a) Cable Route Layout Drawings

   b) Cable schedules

   c) Switchboard Design (Cubicle component Layouts, Door Layouts, Bus bar arrangement and General Arrangement Drawings)

2) PLC and SCADA

   a) PLC Design (Panel Layouts, Component List) and General Arrangement

3) Instrumentation

   a) Instrumentation list with the make and model of all proposed items

   b) Design and drawings

PD2.2.4 Required Submissions within 70 days

The Contractor shall submit the following for acceptance within 70 days from the Commencement Date:

1) Updated Contractor's drawing and document register.

2) Two draft copies of the Operation and Maintenance Manual

3) PLC and SCADA design documentation

4) Instrumentation table including, as a minimum, the make, model, range and any set points of units to be installed.

5) Cable schedule for power, data, control and instrumentation cables. This shall include the cable type, conductor material, insulation, protection, voltage rating, start and finish points, route length, duty, load, voltage drop, core area, no. of cores, no. of cores used and gland size. For cable voltages above 400 Volts, the schedule shall also include the purchase details, specification and date of manufacture.

PD2.2.5 ***Required Submissions during Contractor's design phase of the Works***

The Contractor shall submit the following design documents and drawings, in the timeframes stated in the approved program.

1) LV installation
   a) Switchboard Design (Wiring Schematics, Cubicle component Layouts, Door Layouts, Bus bar arrangement) and General Arrangement Drawings
   b) LV switchgear Type Test Certificates (as applicable)
   c) LV switchgear In-house FAT Test Report
2) PLC
   a) PLC Wiring Schematics
   b) In-house FAT Test Report
3) Instrumentation
   a) Hook-up & Loop Drawings

PD2.2.6 **Required Submissions before Commissioning the Works**

Prior to commencement of the Tests on Completion and the start of the 28 day Trial Operation Period, the Contractor shall submit two copies of the Installation, Operation and Maintenance Manual as specified in the Specifications.

PD2.2.7 **Before Taking-Over Certificate**

Before the Taking-Over Certificate is issued, the Contractor shall provide:

1) During Pre-Commissioning
   a) Have the corrected (ie. Second draft) of the Installation, Operation and Maintenance Manual on site. The contractor shall use this version to note all corrections, changes and/or adjustments and correct the final version.
2) Tests on Completion (Clause 9.1 of General Conditions of Contract)
   a) Comprehensive report containing detailed schedules and documentation to record all pre-commissioning tests undertaken and the results of these, demonstrating that the Works have passed the pre-commissioning tests

b) Comprehensive report containing detailed schedules and documentation to record all commissioning tests undertaken and the results of these, demonstrating that the Works have passed the commissioning tests. The report shall include the PLC and SCADA system commissioning procedure and schedule of alarm messages, which shall additionally inserted in the Operation and Maintenance Manual.

c) During the trial operation;

i) Fortnightly reports detailing the equipment failures, plant performance and problems, training logs, and providing an evaluation of the performance of the Employer's operators, and

ii) a report on the completion of the trial operation

3) Installation, Operation and Maintenance Manual

a) The Manual shall comply with the specifications for O&M manuals as detailed in the Specifications.

b) All drawings supplied in terms of the Required Submissions within 42 and 70 days above, corrected where necessary to be "as built".

c) Six copies of the approved version of the Installation, Operation and Maintenance Manual

d) Soft copy of the Installation, Operation and Maintenance Manual. The drawings shall be configured for AutoCAD, or equivalent with the latter being both in editable ("dxf" or "dwg" format for drawings, MS Word format for documents and MS Exel format for schedules) and PDF format.

PD2.3 Approvals and Inspections

PD2.3.1 Approvals before Manufacturing and Inspections

All drawings which are to be submitted in terms of the Contract shall be approved in principle by the Engineer before any manufacturing or inspection of manufactured or supplied items commences. Refer to Clause 5 of the FIDIC Conditions of Contract for further information in this regard.

PD2.3.2 Quality Control Plans

Quality Control Plans (QCP's) of all manufactured items shall be submitted to the Engineer for approval prior to the start of any manufacturing. The Engineer shall review these QCP's and identify any hold points which he deems necessary for the specific item of equipment. The necessary hold points identified by the Engineer shall be taken into consideration and failure to adhere to any hold points shall constitute a failure of approval and any costs incurred in this regard shall be borne by the Contractor.

PD2.3.3 Inspections

Inspections will be done in accordance with sub-clause 7.4 of the General Conditions of Contract. The Contractor shall arrange timeously with the Engineer for any inspections, at least 5 working days in advance. The inspections carried out by the Engineer shall not absolve the Contractor from his responsibilities with regards to the correctness of any of the Works.

PD2.4 Employer's design

The Employer's design work will include all civil services as mentioned in this document.

PD3 PROCUREMENT

PD3.1 Preferential procurement procedures

PD3.1.1 Requirements

All requirements for preferential procurement shall be as specified in Section T2.2 of this document.

PD3.2 Subcontracting

PD3.2.1 Scope of mandatory subcontract works

The Contractor may subcontract portions of the Works included in the Contract. Clause 4.4 of the General Conditions of Contract makes provision for subcontracting.

Subcontract work provides opportunities for small or specialist businesses and can also be used to secure contract participation goal credits for HDI participation or other specific goals, where applicable. In the interests of all parties, the Contractor shall enter into a written subcontract agreement with each Subcontractor.

Where participation credits are claimed by the Contractor in respect of subcontractors, suppliers, manufacturers and/or service providers, the Contractor shall provide evidence that the sub-contractors, suppliers, manufacturers and/or service providers are based locally.

Notwithstanding the above, contract participation goal credits may not be claimed for work undertaken in respect of provisional sums and prime cost items.

PD3.2.2 Subcontracting procedures

All proposed subcontractors should be noted in Section T2.2 and will be approved by the Employer prior to the award of the contract.

PD3.2.3 Provisional Sums

Where Provisional Sums have been included in the Bill of Quantities and the work is to be done by a sub-contractor, the procedure to be followed is:

- Where monetary allowances for provisional sums or prime costs items have been allowed and the monetary allowance is less than R300 000, the Contractor shall invite three quotations from suitably qualified subcontractors, etc. for the required scope of works. The selection of the Subcontractors, etc. shall be approved by the Engineer.

- Where monetary allowances for provisional sums or prime cost items have been allowed and the monetary allowance is greater than R300 000, an open tender process will have to be followed in respect of a subcontractor for this work, unless otherwise advised and approved by the Employer. In such cases the tender will be issued by the Engineer on behalf of the Contractor.

The quotes shall include full technical descriptions as well as a breakdown of prices, which shall be submitted to the Engineer for approval.

PD4 MANAGEMENT

PD4.1 Programming and Planning

The Construction Programme to be submitted to the Engineer, within 14 days from the commencement date, by the Contractor and shall meet the following requirements:

(a) Be in the form of a bar chart.

(b) Clearly indicate the start and end dates and duration of all construction activities and identify the critical path.

(c) Take full cognizance of all the Contractor's risks and obligations in terms of the Contract.

(d) Indicate key dates in respect of work to be carried out by others.

(e) Indicate key dates in respect of information to be provided by the Engineer and/or others.

The said Programme and all revisions thereto shall also be provided to the Engineers in electronic digital format using the MS PROJECT software.

The programme shall be updated monthly during the contract period. In addition to the above, a monthly cash flow forecast shall also be submitted to the Engineer.

The following key dates shall apply:

(a) It is anticipated that the Contract will be awarded within 3 weeks of the tender closing date.

(b) It is anticipated that the instruction for Commencement of the Works will be within 14 days of the Commencement date as per Clause 8.1 of the General Conditions of Contract.

(c) The Contractor shall complete the entire Works within the period stated in C1.2: Contract Data

(d) The date for completion of the whole of the works excluding the Trial Operation Period is 30 September 2022.

PD4.1.1 General Allowances

When drawing up his programme, the Contractor shall, take into consideration and make allowance for, inter alia:

a) expected weather conditions and their effects,
b) known physical conditions or artificial obstructions,
c) searching for, dealing with and carrying out alterations to the existing services,
d) the accommodation of public access and traffic,
e) the provision and implementation of the health and safety plan in terms of the Construction Regulations, 2014 of the Occupational Health and Safety Act, and

PD4.1.2 Extension of time resulting from abnormal rainfall

Extension of time will only be considered for rainfall or saturated conditions that will influence the quality of work and will be calculated in accordance with the following method:

a) The Contractor shall, in his programme, allow for the anticipated number of working days on which work could be delayed - as given in the Schedule below.

b) Extension of time will be calculated for each calendar month or part thereof over the full period for the completion of the Work, plus any approved extension thereof, as follows:

i) A delay caused by abnormal rainfall will only be accepted for extension of time if, in the opinion of the Engineer, it delays an item or items which lie on the critical path determined by the Contractor's programme. Only delays on working days will be considered.

ii) Abnormal rainfall will be considered to be days, as approved, on which rain delayed operations, less the anticipated number of days given in the Schedule below.

iii) The net extension of time determined for each month, which may be negative, shall accumulate algebraically to determine the net number days for extension of time due to abnormal rainfall, but a negative total at the end of the construction period will not be taken into account.

iv) Where a portion of a month is involved, a pro rata number of days shall be calculated.

SCHEDULE

Anticipated number of working days on which work could be delayed as a result of rainfall and saturated conditions.

Month	Days	Month	Days
January	1	July	5
February	1	August	4
March	2	September	3
April	2	October	2
May	4	November	1
June	5	December	1

PD4.1.3 Review of progress

The Contractor shall review his progress each month and should progress lag behind the latest accepted programme, by more than 2 weeks, he shall submit a revised programme and method statement of how he proposes to make up the lost time. If, in the opinion of the Engineer, such revised programme will not make up the lost time, the Engineer shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

PD4.2 Contractor's Responsibility In Terms Of The OHS ACT

The Contractor shall be responsible for complying with the Occupational Health and Safety Act, Act 85 of 1993, and specifically the Construction Regulations.

The Contractor is referred to Part T1.2 Tender Data and the Health and Safety Specification (see PD4.6) in this regard.

PD4.3 Works Not To Interfere

The Contractor is to take cognizance of the fact that the proposed site for the Works is the Albertinia Waste Water Treatment Works and shall ensure that the Works do not affect operations of the aforementioned facilities.

PD4.4 Unauthorised Persons

The Contractor shall keep unauthorized persons from the Works at all times.

PD4.5 Electronic Payments

The Contractor shall provide his banking details to enable electronic payments to be made.

PD4.6 Health And Safety

PD4.6.1 Health and safety requirements and procedures

a) In terms of the provisions of Section 37(2) of the Occupational Health and Safety Amendment Act, 1993 (Act 85 of 1993), hereinafter referred to as the Act, the following arrangements and procedures shall apply between the Contractor and the Employer to ensure compliance by the Contractor with the provisions of the Act:

(i) The Contractor undertakes to acquaint the appropriate officials and employees of the Contractor with all relevant provisions of the Act and the Regulations promulgated in terms of the Act.

(ii) The Contractor undertakes that all relevant duties, obligations and prohibitions imposed in terms of the Act and Regulations on the Contractor will be fully complied with.

(iii) The Contractor accepts sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and Regulations and expressly absolves the Employer from himself being obliged to comply with any of the aforesaid duties, obligations and prohibitions, with the exception of such duties, obligations and prohibitions expressly assigned to the Employer in terms of the Act and its associated Regulations.

(iv) The Contractor agrees that any duly authorised officials of the Employer shall be entitled, although not obliged, to take such steps as may be necessary to monitor that the Contractor has conformed to his undertakings as described in paragraphs (i) and (ii) above, which steps may include, but will not be limited to, the right to inspect any appropriate site or premises occupied by the Contractor, or any appropriate records or safety plans held by the Contractor.

(v) The Contractor shall be obliged to report forthwith to the Employer and Engineer any investigation, complaint or criminal charge which may arise as a consequence of the provisions of the Act and Regulations, pursuant to work performed in terms of this Contract, and shall, on written demand, provide full details in writing, to the Employer and Engineer, of such investigation, complaint or criminal charge.

(vi) The Contractor shall furthermore, in compliance with Constructional Regulations 2014 acquaint himself with the requirements of the Employer's health and safety specification as laid down in regulation and prepare a suitably and sufficiently documented health and safety plan for approval by the Employer or his assigned agent. The Contractor's health and safety plan

and risk assessment shall be submitted for approval, to the Employer or his agent, within 14 days of the Commencement Date and shall be implemented and maintained from the commencement of the Works.

The Contractor shall at all times be responsible for full compliance with the approved plan as well as with the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

(vii) The Employer, or his assigned agent, reserves the right to conduct periodic audits, as contemplated in the Construction Regulations 2014, to monitor that the Contractor is compliant in respect of his obligations. Failure by the Contractor to comply with the requirements of these Regulations shall entitle the Engineer, at the request of the Employer or his agent, to suspend all or any part of the Works, with no recourse whatsoever by the Contractor for any damages incurred as a result of such suspension, until such time that the Employer or his agents are satisfied that the issues in which the Contractor has been in default have been rectified.

(viii) The proposed type of work, materials to be used and potential hazards likely to be encountered on this Contract are detailed in the PD4 and PD5: Construction, the Bill of Quantities, the Drawings, and in the Employers' health and safety specification, which is contained in the Particular Specifications.

Payment items are included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

PD4.6.2 Health and Safety Plan

Without limiting his obligations and liabilities in terms of the Construction Regulations, 2014 of the OHS Act, the Contractor, in his Health and Safety Plan to be submitted in terms of the Contract Data, shall inter alia deal with the safety provisions he will set up in respect of the aspects specified in the Specifications.
The Health and Safety Plan shall be neatly set out in a lever-arch type file, with labelled dividers for each section.
A copy of the approved Health and Safety Plan shall be kept on Site and made available upon request.

PD4.6.3 Protection of the public and Employer's staff

The Contractor shall at all times ensure that his operations do not endanger any member of the public, or the Employer's staff.
Open excavations and other hazardous conditions on site shall be barricaded and precautions shall be taken to protect the public from the same in terms of the OHS Act.

As the Works are on operating pump station sites, the Contractor shall take special precautions to prevent access to any danger areas on the Works, e.g. by temporary barricades, notices and/or fencing.

The Contractor shall direct, control, facilitate and safeguard all pedestrian traffic during construction of the Works, provide all notices, and arrange for watching and lighting in accordance with the requirements of the relevant authorities.

PD4.6.4 Health and safety specialist

The contractor shall employ a health and safety specialist, with suitable and proven qualifications, either on full-time or part-time basis, for the duration of the Contract. This specialist shall assist with the preparation of the health and safety plan, shall provide on-going training for all construction staff (at least 1 hour per week whilst work on site is in progress, in the form of weekly tool-box talks), and shall assist with the upkeep of the health and safety plan and associated regular inspections etc.

The requirement for a weekly presence on Site necessitates that the Health and Safety Specialist be based locally, at least for the period while the Contractor is working on Site (i.e. during delivery, installation, testing and commissioning).

PD4.6.5 Monthly health and safety reports

The health and safety specialist required in terms of PD4.6.4 shall submit a report to the Engineer at the monthly site meetings, detailing the state of health and safety on the site over the last month, new risk assessments added, potential new risks, new precautions taken, and summarising the results of various inspections required in terms of the health and safety plan, etc. If this report is not submitted at each monthly site meeting, the Engineer shall impose a fine of R5000.00 on the Contractor, in each instance.

PD4.7 Environmental Management

The Contractor will be responsible for managing his activities so that damage to the environment is minimised, as per the specifications contained within Particular Specification PSEM.

PD4.7.1 Neatness of the site

The general neatness and tidiness of the area of the Albertinia Waste Water Works of particular concern. The Contractor shall, therefore, on a day-to-day basis, keep the area of the Works in a condition acceptable to the Engineer.

PD4.7.2 Accommodation of traffic on public roads occupied by the contractor

All roads adjacent to the construction site will be used by public traffic. The Contractor will initiate such process as to make the road safe for public use.

PD4.7.3 Other contractors on site

Other Contractors may make use of the site other than this contract.

PD4.4 Subcontractors

The Contractor is responsible for work carried out on his behalf by subcontractors. The Engineer will not liaise directly with such subcontractors, and all problems relating to payments, programming, workmanship, etc, shall be the concern of the Contractor and the subcontractor, and the Engineer will not be involved.

PD5 CONSTRUCTION

PD5.1 Applicable Standardised Specifications

For the purpose of this Contract the following relevant Standard Specifications not bound into this document shall apply:

- SANS standards
- BS standards
- ISO standards

It shall be the responsibility of the Contractor to obtain, at his own expense, the most recent copies of the relevant editions of the documents referred to above.

PD5.2 Site-Related Items

PD5.2.1 Services and Facilities

A specific area in close proximity to or on the Site of the Works will be made available by the Employer to the Contractor for the Contractor's site establishment. The specific area for the Contractor's site establishment will be identified to the Contractor by the Engineer and the Contractor shall have sole use of such area, free of charge, for the duration of the Contract. The Contractor shall use this area only for the purposes of erecting his site offices, workshops, stores and other facilities required for the execution of the Contract. The Contractor shall not use the area nor allow it to be used for any purposes not directly associated with the execution of the Contract. No housing shall be allowed on the Site.

The Contractor shall be responsible for arranging, at his own cost, for the provision of all services he may require in the area, as well as elsewhere on the Site. These services shall include, but not be limited to, water, electricity, sanitation and security.

Should the Contractor deem the area made available by the Employer to be inadequate or unsuitable for the Contractor's particular needs, then the Contractor shall be at liberty to make his own arrangements with the owners of other sites which he considers are better suited to his needs; provided always that the use by the Contractor of any area other than that made available to him by the Employer shall be subject to the prior written approval of the Engineer, which approval shall not be unreasonably withheld; and provided further that the Contractor shall have no claim against the Employer in respect of any costs incurred by him, either directly or indirectly in consequence of utilising any area other than that made available to him by the Employer, and which costs exceed those costs allowed for by the Contractor in his Tender.

PD5.2.2 Permits and wayleaves

The Contractor shall be responsible to obtain all wayleaves required under the Contract.

PD5.2.3 Features requiring special attention

(a) Site maintenance

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner, and shall keep the Site free from debris and obstructions.

(b) Employment of local labour

It is the intention that this Contract should make maximum use of the local labour force that is presently under-employed. To this end the Contractor shall limit the utilisation on the Contract of non-local employees to that of key personnel only and to employ and train local labour to the extent necessary for the execution and completion of this Contract.

(c) Subcontractors

All matters pertaining to subcontractors (including Nominated Subcontractors) and the work executed by them shall be dealt with directly between the Engineer and the Contractor in the context of all subcontract work being an integral part of the Works for which the Contractor is responsible.

The Engineer will not liaise directly with any subcontractors nor will he issue instructions concerning the subcontract works directly to any subcontractor.

All matters arising from the subcontract agreements shall be dealt with directly between the Contractor and the subcontractors and the Engineer will not become involved

PD5.2.4 Site Usage

Access to site shall be limited to the Contractor and his personnel. The Contractor shall be responsible to control unauthorized entry to the site and shall inform the Engineer of any breach of such rules. The site shall be managed and used for its intended purpose.

PD5.2.5 Other Contractors

Other contractors may be engaged by the Employer and will be present on site during the period of the contract.

The Contractor shall arrange or adjust as necessary, the sequence of its work so as not to delay the programmes of the existing and new contractors. The programmes of the existing contractors are available at the offices of the Engineer for perusal.

PD5.2.6 Technical Meetings

Technical meetings shall be held on an ad-hoc basis as required either by the Engineer or the Contractor.

The Contractor shall arrange for the Contractor's Representative as well as the Designer and Director to be present at these meetings as and when required.

The Engineer will make notes of the decisions taken and distribute these to the Contractor's Representative within two days after the meeting.

PD5.2.7 Site Meetings

Site meetings shall be held monthly. The Contractor shall arrange for the Contractor's Representative to be present at these meetings.

The Engineer will take minutes of these meetings and distribute these to all relevant parties at least one week prior to the next site meeting.

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HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :

MECHANICAL AND ELECTRICAL WORKS

C3.2: MECHANICAL SPECIFICATIONS

HESSEQUA MUNICIPALITY

HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT : MECHANICAL AND ELECTRICAL WORKS

PSM 1 SCOPE

This clause specifies the Works for this Contract.

PSM 1.1 General

The Albertinia Waste Water Treatment Works (WWTW) is an existing, active treatment works in the Western Cape. All the work under this contract shall entail screening equipment, raw waste water pumps and irrigation pumps at the Works.

The Albertinia WWTW was designed for an ultimate capacity of 700 kℓ/d, currently it is averaging 473 kℓ/d.

The Peak Wet Weather Flow is 50 ℓ/s. The raw waste water has an abnormal high content of rags and fibres as well as sand, gravel and rocks.

PSM 1.2 Work included in this contract

The chief items which shall be provided and performed by the Contractor are as follows:

- Disposal or transfer off site of items identified by Employer and Engineer to a suitable location identified by the Employer i.e. One drum screen, hand raked screen, switch boards, etc.
- New mechanical front raked screen at inlet to treatment works
- New washer compactor at inlet works
- New hand raked screen and rake at inlet works
- New self priming screened raw waste water pumps, pipes and specials
- New mixers complete with mountings and lifting equipment
- New submersible centrifugal borehole pumps for irrigation, pipes, disc filter, specials, flow meter etc.
- Electrical and Control Equipment
- Instrumentation
- Earthing and Lightning Protection
- Spares
- Signage
- Performance Acceptance Testing
- Tests on Completion
- Commissioning
- Trial Operation Period

- Training
- Rectification during Defects Notification Period
- Maintenance during Defects Notification Period
- Operating and Maintenance Manual including as-built drawings

PSM 1.3 Civil Work

All civil related work unless otherwise specified in this document will also form part of the scope of the appointed Contractor. The reinforced concrete work for the inlet works, modification of existing screened raw waste water pump station, irrigation pump station and plinth of emergency generator set will be constructed under separate contract by a civil contractor.

Notwithstanding the above, a rate for a precast type concrete plinth of the type manufactured by Messrs MDL Engineering (044 – 874 1136) has also been requested should the supply and installati on of same under this contract prove to be the most feasible option to the Municipality.

PSM 1.4 Design

PSM 1.4.1 General

FIDIC General Condition 5 states that the Contractor shall be responsible for the design of the Works and that the design shall be prepared by engineers or other professionals.

PSM 1.4.2 Safety - OHS Act

In addition to safety requirements during the construction of the Works on Site, the Contractor is responsible for ensuring that all of the equipment supplied and the complete installation comply with the Occupational Health and Safety Act, Act 85 of 1993 and the regulations promulgated thereunder.

PSM 1.4.3 Safety - General

Safety shall be an all-important and overriding consideration and proper attention shall be paid to this aspect at the design stage. Installations which do not comply with the OHS Act shall be corrected by the Contractor at no cost to the Employer.

Equipment which is potentially dangerous shall be designed in accordance with a relevant South African or international Standard.

Hazards must be avoided or guarded to the satisfaction of the Engineer. Nip points shall be guarded. Sharp corners shall be rounded off. Items such as operating handles, supports and protrusions shall be kept clear of access ways or marked accordingly.

The Contractor shall be responsible for covering all unsafe gaps and openings left in structures after installation.

Each motor driven device shall be provided with an emergency stop station in an appropriate position.

Trip wires shall be provided along the accessible side/s of moving conveyor belts, chains, etc. irrespective of operating speed and in addition to any guards provided. These shall stop the driving motor when pulled.

PSM 1.4.4 Design Principles

Mechanical engineering design shall ensure safety, robust construction, reliability, durability, prevention of avoidable corrosion, neatness as well as ease of maintenance and operation.

Design shall, as applicable, be based on:

(a) the full range of duties which can be reasonably anticipated;

(b) the maximum pressure or vacuum which can be produced by pumps, blowers and compressors under all conditions including blocked or closed inlet and outlet circuits;

(c) conservative service and safety factors based on approved standards or laid down in the printed specifications of reputable and approved manufacturers;

(d) Twenty four hour per day operation (unless specified otherwise).

(e) a minimum life of 100 000 hours for large items of equipment before repair or major part replacement;

(f) Prevention of serious damage from normal operational problems such as blockages, blinding, jamming, seiZute, malfunction and, as far as is practical,

(g) mal-operation (assuming that these occurrences cannot be avoided by good design).

(h) the power and torque transmitted by the driver system under full load and stalled conditions;

(i) machines with non-overloading characteristics shall be selected wherever possible; e.g.: motors shall be sized so that they cannot be overloaded by the driven machine:

PSM 1.4.5 Fail Safe Operation and Protections

Where damage can occur from normal operational or other foreseeable problems, plant, equipment and systems must be designed to be fail safe; i.e. must have built in redundant elements, or be fail-to-safe; i.e. must return to a safe condition where no further damage can be done in the event of a failure, malfunction, mal-operation, overload and, as far as practical, misuse. All reasonable and economically justifiable protections to prevent or limit damage to plant and equipment, particularly in high- risk situations, must be incorporated.

Protections shall:

(a) be directed at the source of the problem, limit forces to safe levels and act quickly enough to prevent damage (electrical thermal type overloads are inadequate);

(b) stop or prevent from starting all equipment at risk;

(c) activate an alarm with a labelled indicator on the control panel whenever a protection operates;

(d) operate reliably after long inactive periods exposed to corrosive and dirty conditions.

Contractors shall highlight equipment limitations which can be exceeded during operation and cannot be guarded against.

PSM 1.4.6 Moving Parts

The following general requirements apply not only to machines but to all equipment with moving parts such as headstocks, extension spindles, swivelling davits, heavy duty hinges, pivots and the like:

(a) All rotating or swivelling shafts, pins and the like, shall be adequately supported, guided and restrained by lubricated or self-lubricating bearings, collars and/or bushes.

(b) Swivelling joints on linkages and the like shall be of the "universal" or fork and rod type with bearings or bushes fitted to the eyes or forks.

(c) Abrasion resistant materials and slow speed operation shall be used for abrasive applications. Raw sewage and sludge shall be regarded as abrasive.

(d) All applications associated with wastewater shall be regarded as corrosive and materials of construction shall be selected to suit.

(e) Susceptibility to fatigue failure shall be minimised by proper design and manufactu ring procedures. Sharp changes in section and welding shall be avoided in components subject to fluctuating stress.

(f) The locking of nuts and pins in position shall be done to the approval of the Engineer.

(g) Wearing parts shall be designed for ease of removal and replacement.

PSM 1.4.7 Arrangement and Mounting

The arrangement and general design shall take the following requirements into consideration:

(a) Lifting eyes, lugs, hooks, etc., shall be provided on heavy or large items to facilitate handling.

(b) Castings or fabrications shall have machined pads for seating and be mounted on either soleplates or baseplates as appropriate.

(c) Where accurate alignment is required, positioning pins and/or jacking screws shall be provided.

(d) The needs of operation and maintenance including neatness, access, working space, safety, cleaning, adjustment, handling, assembly, alignment, disassembly, removal, etc.

(e) With plant and equipment to be mounted on or against concrete or brick structures built by others, provision shall be made for adjustment in the mechanical design. Any special accuracy requirements must be specified on the Contractor's Documents.

PSM 1.4.8 Prevention of Corrosion

The Contractor shall review all designs from a corrosion protection point of view. Any details which might have a negative effect on the corrosion protection and the future application of coatings are to be brought to the Engineer's attention for a ruling prior to commencement of work.

All items shall be designed to minimise corrosion in the environment in which they will be exposed. Particular emphasis shall be placed on accessibility for surface preparation and the application of coatings. The detailed requirements for corrosion protection are dealt with elsewhere in this document.

Mastics, sealants, insertion rubber or suitable gasket material shall be used to seal unavoidable crevices such as bolted connections; e.g. under guardrail feet.

The design of articles shall ensure that surfaces of corrodible materials, such as carbon steel, shall be accessible for initial coating and for maintenance. The use of back-to-back angles, partially open box sections or inaccessible stiffeners shall be avoided. Fabrication openings shall be of sufficient size to enable fettling, blast cleaning, painting, pickling and passivation and particular attention shall be paid to the fabrication and inspection requirements for internal weld surfaces in pipework.

PSM 1.5 Control

PSM 1.5.1 General

Control systems shall comply with the requirements as detailed throughout the specifications.

PSM 1.5.2 Equipment

Equipment control and system control is specified in the equipment clauses.

PSM 1.5.3 Layout drawings, PIDs and PFDs

See drawing register.

PSM 2 MECHANICAL FRONT RAKED SCREENS

PSM 2.1 Specification

Refer Zut 4001.

PSM 2.2 Scope

The Contractor shall provide and install all items specified in this clause, including the following:

- Removal and disposal of installed equipment
- Mechanical front raked screen
- Safety closure plates
- Drive motor and gearbox with over-torque cut-out device for each screen
- Mounting brackets and anchor fasteners
- Ultrasonic level transmitters (2 per screen. One upstream and one downstream)
- Outlet chute
- Associated equipment
- Installation of equipment
- Commissioning of installed equipment

PSM 2.3 Detailed Requirements

PSM 2.3.1 General

Currently there is one rotating drum screen and one hand raked screen at the inlet works. The Contractor shall remove these screens and dispose of it at a suitable location identified by the Employer. The screens shall remain the property of the Employer.

One new mechanical front raked screen shall be provided by the Contractor. The screens shall be installed in the flow channel and a hand raked screen shall be installed in the overflow channel.

The new screen shall be installed at the location as shown on the drawings. The mechanical contractor shall be responsible for chipping, grouting and mounting the new screens in the inlet works channels.

Sluice gates complete with guide rails and hand wheel operated opening and closing equipment have been provided by the civil contractor.

PSM 2.3.2 Performance Requirements

The screens shall be designed to remove a wide variety of solids from the wastewater flow. Organic and inorganic matter can be expected in the flow which is currently pumped and gravitated to the works. It can be expected that large, heavy objects such as wooden planks, rocks, bricks etc. as well as long, stringy, fibrous materials and hair may enter the inlet channel and the screen shall cope with all such solid materials.

The head loss through the each screen shall not be more than **250 mm** at the maximum flow of 50 ℓ/s for a 35% blinded screen.

The downstream water depth shall be 300 mm at the flow of 50 ℓ/s and the upstream water level of 800 mm shall not be reached with the screen in operation and 35% blinded.

Supporting calculations/test results shall be provided with the tender submission in order to verify this.

PSM 2.3.3 Operation and Control

Under normal operation, duty the screen shall automatically rake based on adjustable time intervals or exceedance of an adjustable maximum difference between the upstream and downstream levels.The screen shall also automatically rake when a high level upstream of the screen is observed. Manual activation of the screen's rake mechanisms shall be provided. When the a screen is stopped as a result of the operation of a protection such as the over torque cut out, an alarm shall be activated.

PSM 2.3.4 Design and Construction of Front Rake Screens

The approximate dimension of the channel is 800 wide and the channel is 1 200 mm deep. The contractor shall confirm the dimensions before ordering/fabricating/installing equipment. The normal operating range of flow in the channel is from 0 kℓ/d to 700 kℓ/d.

The screen shall be the full width of the channel. The screen shall be manufactured of 316 L or 304 L stainless steel. The mechanical screen element's bar spacing (aperture) shall be 10 mm. The screen shall discharge the removed screenings into a washer / compactor.

Lower bracket bearing shall have a stainless steel casing, shaft of white cast iron and a ceramic (silicon carbide) low friction bushing.

Bars shall have a teardrop cross section. Teardrop bars shall have a width of 8mm, a depth of 60 mm and a tail width of 5 mm.

The bar rack shall be made up of equally sized sections securely fastened to the frame of the screen and be readily removable.

Screens without the ability to replace individual bar screen sections will not be acceptable.

The bar rake shall have a horizontal section on the canal floor before the incline section.

Screens with single rakes shall not be approved. Screens employing brushes and spray Water for removal of screenings shall not be acceptable.

The screen shall incorporate mechanical over-torque switches.

The screen frame shall not be grouted into recesses in the channel walls but shall be mounted using supports fixed to the top of the channel walls. The contractor shall grout at the foot of the screen to ensure that no crevices are formed. The Screen shall be sealed against the channel walls. Flow shall not be allowed to pass between the screen and the channel wall.

PSM 2.4 Spares

Specified elsewhere.

PSM 2.5 Testing Requirements

The over-torque cut-out of each screen shall be tested and proven during commissioning of the equipment. The head loss over each screen shall also be measured and monitored during commissioning and shall adhere to the specifications.

PSM 3 WASHER COMPACTOR

PSM 3.1 Specification

Refer Zut 4016.

PSM 3.2 Scope

The Contractor shall provide and install all items specified in this clause, including the following:

- Washer Compactor units
- Chutes as required
- Supports
- Drainage and overflow pipework
- All required valves
- Installation of equipment
- Commissioning of installed equipment

PSM 3.3 Detailed Requirements

PSM 3.3.1 General

The installation shall be designed to fit the structures as shown on the drawings.
Screenings from the inlet works screens shall be deposited directly into the screenings wash press.

The washed and pressed screenings shall be deposited into a skip or wheelbarrow adjacent to the washer compactors.

The washer compactor shall be equipped with a screw press driven by a geared motor and a washing unit consisting of a hopper and agitator mounted above the screw press. The screw press shall also be equipped with easily replaceable brushes used for clearing the perforated drainage portion of the trough.

Water and any screenings from the wash press overflow shall flow under gravity to the channel upstream of the screens. The drainage pipework shall discharge back into the common channel upstream of the screens.
The wash press shall be installed at floor level.

Water for the washer compactor shall be supplied from the existing water supply.

PSM 3.3.2 Performance Requirements

The wash press shall remove faecal matter and excess moisture from the screenings. Compaction shall ensure that the dry substance contents of the washed and pressed screenings are no less than 50%.

The organic content of the washed screenings shall be minimal and shall have a grey / white colour. Brown unwashed screenings shall not be acceptable.

PSM 3.3.3 Operation and Control

The wash press shall be fully automatic. Once sufficient water and screenings have been deposited in to the hopper of the screenings wash press, a wash cycle shall be initiated. Should it be necessary, additional water may be added. In addition, a manually operated valve shall be provided that may be used to add water to the wash press if necessary. The washer compactor shall complete a washing sequence at least every 12 hours, this interval shall be adjustable.

PSM 3.3.4 Design and Construction of the Screenings Wash Press

The units shall be designed to handle the full flow of screenings and wash water from the screens as specified elsewhere.

The Screenings Wash Press shall be manufactured from 304L stainless steel.

The washing agitator shall be designed so that screenings do not accumulate on or behind the impeller. The water level in the wash press shall be measured by a pressure sensor mounted on the hopper. The drain valve shall be a motorised ball valve. Integrated limits in the actuator shall be used for ensuring the correct operation of the valve and wash press.

Shafted screw shall transport screenings from the trough area through the washing zone and shall force the compacted screenings through the discharge pipe. The shafted screw shall be fabricated fr om 3mm thick 304L stainless steel. Its 80mm minimum shaft diameter shall receive wash water from the water manifold and shall introduce it into the washing zone through at least four 5mm diameter openings.

The screw flights shall have a minimum thickness of 5mm in the trough area, a minimum thickness of 10mm in the perforated washing zone, and a minimum thickness of 10mm in the compression zone. The outside diameter of the screw shall be at least 200mm and shall have a 150mm flight pitch in the trough area and washing zone, and a 100mm pitch in the compaction zone. The last flight of the screw shall have a 10mm thick layer of Hardox 400 welded to the surface of the 10mm thick stainless steel flight to reduce wear resulting from compaction of the screenings. The complete screw conveyor shall be manufactured from 304L stainless steel.

A stainless steel backed brush with nylon bristles shall be attached to the flights of the shafted screw by means of stainless steel holder clips and fasteners along the entire length of the perforated washing zone.

A shaft-less screw shall not be acceptable. A screw manufactured from carbon steel shall not be acceptable.

An overflow pipe shall be provided that shall discharge as specified above.

Wash water shall be provided at the compaction zone and to the drainage trough. Flushing points shall be provided on the drain and overflow pipelines. Each point shall be fitted with a manually operated ball valve and water shall be piped to these points using 304 L Stainless steel piping, fittings and valves.

The water supply piping and fittings shall be from 304 L Stainless steel or 316 L Stainless steel.

The drainage piping shall be flanged and fabricated from 304L stainless steel . Any required puddle pipes shall be from 316 L stainless steel.

The washer compactor shall discharge into a skip or wheelbarrow.

PSM 3.4 Spares

Specified elsewhere.

PSM 3.5 Testing Requirements

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works. The Contractor shall allow for all costs associated with testing the operational performance of the equipment.

PSM 4 WASTE WATER PUMPS (AUR 3001)

PSM 4.1 Specification

The pumping equipment shall comply with AUR 3001.

PSM 4.2 Scope of Works

The Contractor shall provide all specified items including the following:

- Self-priming centrifugal solids-handling pumpsets
- Brackets, pipework, specials, air release valves, check valves, valves, supports etc. complete as indicated on drawings and as required.
- Overhead gantry complete hand operated hoist and trolley to lift 2t.
- Pressure gauges, ultrasonic level detectors and switchgear complete.
- Anchor fasteners and pipe supports.

PSM 4.3 Detailed Requirements

PSM 4.3.1 General

Pumps shall be variable speed self-priming solids centrifugal handling waste water pumps capable of handling 80 mm diameter solids in unscreened domestic waste water.

The pumps shall pump the screened waste water to the splitter box where the flow is directed to one or other of the aerobic reactors.

Two new pumps are required (1 duty, 1 standby).

The raw waste water will be highly abrasive and the impellers and other wearing parts shall be manufactured from abrasive resistant material and protected with heard wearing coatings.

PSM 4.3.2 Performance Requirements

Each pump shall have a minimum capacity of 50 ℓ/s at a pumping head of 9.0 m. Duty Point at sump low.

The pump shall be selected to ensure continuous operation at the minimum Head conditions at sump high.

The system curves for sump low (Max) and sum high (Min) are indicated for both conditions in Drawing No. 1001178 CC 0202.

Pipework shall be 304 L Stainless Steel.

Each pumpset shall be tested at the factory and on Site to ensure that the Duty Point is attained.

The guaranteed Duty Point of the pumpsets operating above shall be as follows.

Discharge per pump	50 ℓ/s
Static head (Minimum)	4.7 m
Static head (Maximum)	6.5 m
Estimated friction losses	1.7 m*
Estimated plant losses	0.8 m
Total manometric head	7.2 m to 9.0 m
Guarantee Duty Point	50 ℓ/s @ 9.0 m

Note :

*Plant losses is an estimate and contactor shall calculate losses in plant and adjust this figure

PSM 4.3.3 Operation and Control

The pumps shall operate in a one duty and one standby manner.

In automatic mode an ultrasonic level meter shall start the duty pump at a pre-set high level and switch the pump off at a pre-set low level. An alarm shall be sounded at a pre-set low-low and high-high level.

A secondary system shall be provided by means of ball switches that will switch the duty or standby pump on or off and sound an alarm before the pump sump runs dry or the sump over flows.

The pump will also have no – flow protection as well as the protection described in the electrical Sections

The duty and stand – by pump will change over after each pump cycle to ensure that equal running times are accumulated by each pumps

PSM 4.3.4 Design and Construction of the Waste Water Pumps

Impellers shall be designed and manufactured from ductile/ spheroidal graphite and protected with hard wearing coatings

Mechanical seals suitable for this application shall be fitted to all pumps.

Bearing numbers of all bearings shall be provided.

PSM 4.3.5 Inspections and Testing

Fabrications will generally be inspected by the Engineer after fabrication is complete. The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.
The Contractor shall make arrangements for the Engineer to inspect the installation on Site prior to commissioning.
The Contractor shall successfully demonstrate the following to the Engineer prior to the commissioning of the Works:

a) Operation of all equipment,
b) Achievement of the specified performance requirements.
c) Correct operation of the control system.

PSM 5 **ELECTRICAL MOTORS (1 KW TO 650 KW)**

See Electrical Specification

PSM 6 **MIXERS**

PSM 6.1 **Specification**
Refer to Zut 5010

PSM 6.2 **Scope**

The Contractor shall provide and install all items specified in this clause including the following:

- Two mixers complete (One duty, one stand-by)
- Mountings brackets, rawl bolts etc.
- Lifting equipment to raise, lower and place mixer on paving outside the pump sump
- Switchgear, cabling, electrical control equipment and all other items required to complete the installation.
- Commissioning of installed equipment.

PSM 6.3 **Detailed Requirements**

PSM 6.3.1 **General**

The two mixers shall be installed in the existing pump sump in the positions indicated on the drawings

The liquor to be mixed will be screened raw waste water that may contain strings, rags sand and grid and it will be highly abrasive.

Temperature range may be between 10°C and 25°C.

Depth of liquor may vary between 0.5 m to 2.3 m. No splashing shall occur at the low level.

PSM 6.3.2 **Performance Requirement**

Each of the mixers shall keep this contents of the pump sump in suspension.

The design power input of the mixing system shall be greater than 6 W/ m^3 (i.e. 6 Watt per cubic meter of contents of full sump)

PSM 6.3.3 **Operation and Control**

The duty mixer shall start mixing 30 seconds before the self priming pump starts pumping. The time will be adjustable between 10 seconds and 180 seconds. The duty mixer will be in operation till the pump is switched off. The duty and stand-by mixers will also be controlled by an adjustable timer to avoid long no mixing intervals. This is to avoid settling during times of low waste water flow. This will be adjustable say 5 to 10 minutes on and 30 to 60 minutes off.

The duty and stand-by mixer shall alternate with each pump cycle to ensure equal running times.

PSM 6.3.4 **Design and Construction of Mixers**

The units shall be designed to operate in the harsh and corrosive environment of a raw waste water pump sump without entangling of blades with strings, rags, etc.

The mixer blades and other wearing parts shall be manufactured from abrasive resistant materials.

Special precautions shall be taken to avoid seals and bearings from being damaged by sand and grint.

The mounting structure, mounting brackets, lifting equipment, rawl bolts, etc shall be manufactured from 304 L stainless steel.

The mixers shall be mounted onto the existing pump sump structure and be removable from the outside i.e. without having to climb in to the pump sump and lifting equipment shall deliver mixers to outside of pump sump.

PSM 6.4 **Spares**

Not required.

PSM 6.5 **Testing Requirements**

The correct operation of the equipment and achievement of the performance requirements shall be demonstrated to the engineer prior to commissioning of the Works. The Contractor shall allow for all costs associate with testing the operational performance of the equipment.

PSM 7 **CENTRIFUGAL BOREHOLE PUMPS (AUR 10012)**

PSM 7.1 Specification

Refer to Zut 10012

PSM 7.2 **Scope**

The Contractor shall provided and install two new borehole type centrifugal pumps and ap purtenant pipe work and equipment for the irrigation pumps including the following:

- Pumpset, cables and flow inducer (2 off)
- Ultrasonic level detectors and switchgear complete
- Pipework, specials, pipe supports complete as indicated on drawings and as required
- One double disc filter
- Pump pressure gages including three way isolating cocks
- Air release valves
- Check valves
- Magnetic flow meter
- Overhead hoist and trolley to lift 2 t.

PSM 7.3 Detail Requirements

PSM 7.3.1 General

Pumps shall be variable peed centrifugal borehole pumps. Capable of handling treated waste water effluent. The pumps shall pump the treated effluent to the park and golf course where the treated effluent will be irrigated.

The treated waste water may be aggressive and corrosive with possible high abrasive characteristics as well. The impellers and the wearing parts shall be manufactured from aggressive and abrasive resistant materials and protected with hard wearing coats.

Each pumpset shall be tested at the factory and on Site to ensure that the Duty Point is attached.

The guaranteed Duty Point of each pumpset operating alone shall be as follows:

Discharge per pump	15 ℓ/s
Static head (Minimum)	6.9 m
Static head (Maximum)	9.4 m
Static head (Average)	8.2 m
Required head at sprinkles (say)	30 m
Therefore head required 8.2 m + 30 m	38.2 m
Estimated friction losses	68 m
Estimated plant losses	5.0 m*
Manometric head	111.2 m
Plus 5% pump ageing	5.6 m
Total manometric head	116.8
Guarantee Duty Point	15 ℓ/s @ 117 m

Note :

* Plant losses is an estimate and Contractor shall calculate losses in plant and adjust this figure.

PSM 7.3.2 Performance Requirements

Each pump shall have a minimum capacity of 15 ℓ/s @ 117m Duty Point.

The pumps shall be selected to ensure continuous operation at the minimum Head conditions at sump high. Difference in sump high and dump low is only 2.5 m.
The system curve for sump (Average) only is indicated in Drawing 1001178 CC 0203.

The pipework shall be 304 L stainless steel.

PSM 7.3.3 Operation and Control

The pumps shall operate in a one duty and one standby manner

In automatic mode an ultrasonic level meter shall start the duty pump at a preset high level and switch the pump off at a preset low level. An alarm shall be sounded on a preset low-low and high – high level.

A secondary system shall be provided by means of ball switches that will switch the duty or stand-by pump on an off and sound an alarm before pump runs dry or the sump overflows.

The pumps will also have no-flow protection as well as the protection described in the Electrical Sections.

The duty and standby pump will change over after each pump cycle to ensure that equal pumping times are accumulated by each pump.

PSM 7.3.4 Design and Construction of the Centrifugal Borehole Pumps

Impellers and mechanical seals suitable for this application shall be fitted to all pumps

Bearing number for all bearings shall be provided.

PSM 7.3.5 Inspections and Testing

Fabrications will generally be inspected by the Engineer after fabrication is complete.
The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.
The Contractor shall make arrangements for the Engineer to inspect the installation on Site prior to commissioning.
The Contractor shall successfully demonstrate the following to the Engineer prior to the commissioning of the Works:

d) Operation of all equipment,
e) Achievement of the specified performance requirements.
f) Correct operation of the control system.

HESSEQUA MUNICIPALITY

HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :

MECHANICAL AND ELECTRICAL WORKS

MECHANICAL STANDARD SPECIFICATIONS

Specification	Description
Zut 0001	General Mechanical Requirements
Zut 0002	Operating and Maintenance Manual
Zut 0003	Corrosion Protection
AUR 3001	Waste Water Pumps
Zut 4001	Screen Front Rake
Zut 4016	Washer Compactor
Zut 5010	Mixers
Zut 10012	Centrifugal Borehole Pumps

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HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :

MECHANICAL AND ELECTRICAL WORKS

C3.3: ELECTRICAL SPECIFICATIONS

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PSE 1 **ELECTRICAL SCOPE**

The scope of works for the low voltage (LV) electrical installation is the design, supply, delivery, installation, testing, commissioning and upholding during the trial operation period and the defects notification period of the following equipment and materials:

(a) Supply and installation of new canopy type 150kVA generator for standby electrical power purposes for the plant.

(b) Modification and expansion of the existing Inlet Works MCC (MCC-IW)

(c) Field start/stop stations for all motors and actuators (where not integral to the actuator)

(d) LV cables, trenching, sleeves and cable support systems

(e) Electrical motors and actuators for pumps, screens, valves and penstocks

(f) Earthing and bonding

(g) Disconnection and removal of redundant LV electrical cables and electrical equipment

(h) Certificates of compliance

(i) Labelling

(j) Testing and commissioning

(k) Training

(l) As built drawings and operating and maintenance manual.

PSE 2 **REFERENCE DOCUMENTS**

PSE 1.2 Specifications, documents and drawings

(a) The low voltage installation shall comply with the Zutari Standard Specifications, listed hereunder and described further in each section:

(i) Engineering Standard SPE-EE-0010 - LV Switchgear & Controlgear Assemblies

(ii) Engineering Standard SPE-EE-0011 - LV cables

(iii) Engineering Standard SPE-EE-0012 - Cable Support Systems

(iv) Engineering Standard SPE-EE-0020 - MV & LV Earthing

(v) Engineering Standard SPE-EE-0025 - LV Electric Motors

(b) The Project Specification contains only additional project specific information that is not contained in the Standard Specifications.

(c) Detailed technical information of the equipment specified, and the tenderer's response for equipment offered, can be found in the following Technical Data Sheets:

(i) EL01 LV switchgear assemblies – MCCs, DBs & Kiosks

(ii) EL02 LV switchgear assemblies – Outdoor MCCs

(iii) EL06 LV cables and Cable Supports

(iv) EL08 Small motors <50kW

(d) The Drawings Register with the Engineers Design Drawings applicable to this specification are provided in this document. The drawings shall be read in conjunction with this specification.

PSE 1.2 Appended Schedules

(a) The Engineer's design schedules are included under Appendix B to this document and shall be read in conjunction with this Electrical Specification:

(i) LV Motor and Equipment Schedules

(ii) LV Motor and Equipment Cable Schedules

(iii) LV MCC and Field Control Schedule

(b) These schedules may be affected by the actual mechanical equipment supplied by the Contractor. Tenderers shall price for any changes to the electrical design that are caused by their selection of mechanical equipment.

(c) The schedules shall be finalised by the Contractor during the contract and shall be submitted for approval by the Engineer before procurement and manufacture.

PSE 3 electricity supply

PSE 1.1 General

The Albertinia Waste Water Treatment Works is supplied via the incoming Eskom overhead 11kV network, which is transformed on site to 400V, three phase via pole mounted transformer.

Currently an automated ± 200kVA mobile standby generator provides essential standby power to various critical areas of the plant. Said mobile genset is to be replaced under this contract with a new plinth mounted outdoor canopy enclosed 200kVA unit dedicated to the plant.

PSE 4 LV SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

PSE 4.1 General

a) The new LV motor control centres (MCC) shall be housed in an all weather panel inside the existing control room building as indicated on the drawings.

PSE 4.2 Existing Assemblies

i) A new MCC housing the combined controls of the new Inlet Works, Raw Water and Irrigation pumpstations will be provided.

PSE 4.3 Specific Requirements

a) The MCC and Field Control Schedule (Appendix B) contains details of the starters, control and indication which shall be provided for each MCC and field control station.

b) The Assemblies shall be installed in dedicated MCC rooms or outdoor units, as required.

PSE 4.4 Motor Control Centres & Distribution Boards

a) The LV assemblies required under this contract, and their locations are listed below:

Table 1 Assembly location table

Assembly Name	Assembly Title	Location
WWTW (Phase 1)	MCC Panel	Existing Control Room MCC Building

PSE 4.5 LV Assembly Components

Each MCC and MDB assembly shall consist of the following main components:

a) Main incomer section if required.

b) Functional units for the required pump motor starters, and other equipment (MCCs only).

c) Feeder to building services distribution boards (where applicable)

d) Feeder to UPS in PLC panel (where applicable)

e) Feeder to instrument distribution

f) Feeders to other equipment as specified

Each MCC and DB shall be earthed to the relevant building earth bar (refer to Section PSE 7).

PSE 4.6 Field Control Stations

a) A pedestal mounted start, stop and e-stop station (see MCC and field control schedules in Appendix B) shall be installed within an arm's length of each motor wherever practical.

b) Field control stations shall be manufactured in accordance with drawing for Field Control Stations.

PSE 5 LV ELECTRIC MOTORS

PSE 5.1 General

(a) LV motors, and their installation shall be in accordance with the Engineering Standard SPE-EE-0025 - LV Electric Motors.

(b) Each pump/motor set shall be supplied with protection as described in the control philosophy.

PSE 6 LOW VOLTAGE CABLES

PSE 6.1 General

(a) The LV electrical installation shall be in accordance with the Engineering Standards SPE-EE-0012: *Cable Support Systems*, and SPE-EE-0011 – *LV cables*.

PSE 6.2 Cable details

(a) All single core LV cables shall be PVC/AWA/PVC cables, and all multicore cables shall be PVC/SWA/PVC cables.

(b) The voltage drop from transformer LV terminals s to the equipment terminals shall not exceed 5% of rated voltage at full load and 15% in the case of DOL motor starting currents.

(c) Cables in concrete or brickwork shall be installed in PVC conduits.

(d) Cables shall enter and exit the MCCs from the bottom, from trenches in the MCC rooms.

PSE 6.3 Alterations to existing cable installation

(a) The Contractor shall be responsible for tracing existing cables and shall present his findings in both a cable layout and a single line diagram format to the Engineer, prior to installation of any cables. All cable sizes and relevant circuit breaker ratings shall be included.

(b) Where existing motors and cables are able to be re-used, the existing cables shall be reconnected or extended to the new MCC or local control panels. These cables shall be relabelled as per the new tag numbers.

(c) Once all existing cable routes and sizes have been confirmed, installation of the required cables shall be installed.

(d) Existing cables that reticulate to LV assemblies from the MDB which are not refurbished or replaced under this contract, shall be inspected, tested and cable details reported to the Engineer. In order to confirm the compliance of cables and reconnection capability to the new MDB.

(e) Existing cables shall remain intact as far as possible, and no joints will be permitted.

(f) Cables no longer required shall be removed and delivered to the Client's store facilities off site or disposed of – as per the Client's preference.

PSE 6.4 Installation of cables

(g) Where the Contractor is required to carry out cable trenching, core drilling, chasing or the installation of sleeves, the Contractor shall discuss such activities with the Engineer before undertaking such activities.

(h) For the Inlet Works, new cables shall replace the existing cables and terminations entirely if existing cables are not suitable.

(i) All surface-mounted conduits used for the installation of LV cables shall be stainless steel.

(j) Cables shall enter and exit the MCCs from the bottom of the panel.

(k) Inside the buildings the LV cables shall be installed on surface mounted cable ladder inside the cable trenches, mounted on the cable trench wall. The general routes will be as per the existing routes. The final routes of all cable support systems must be approved by the Engineer on site before installation commences.

(l) Where LV cables enter/exit the MCC rooms, it shall enter / exit via a PVC duct system. All incoming sleeves and openings shall be thoroughly sealed with expanding foam after the cable installation is complete to avoid water ingress into the trenches.

PSE 6.5 CABLE SUPPORT SYSTEM

PSE 6.6 General

(a) The cable supports shall be in accordance with the Engineering Standards SPE-EE-0012 – Cable Support Systems.

PSE 6.7 Cable trays and ladders

(a) Heavy duty stainless steal cable ladders, trays and conduits shall be provided to support cables indoors.

(b) Stainless Steel 316 cable ladders, trays and conduits shall be provided to support cables outdoors.

(c) In general power cables shall be installed on cable ladders, and control and instrumentation cables on wire mesh cable trays.

PSE 7 EARTHING

PSE 7.1 General

(a) The earthing arrangement shall comply with Engineering Standard SPE-EE-0020 - MV & LV Earthing.

(b) The existing earthing system at the Albertinia WWTW shall be investigated and reported to the Engineer. Where possible, the existing earthing shall system shall be used throughout. As part of the investigation, an earth resistivity test shall be conducted.

(c) The earthing arrangement shall be verified for the existing transformer and a report provided to the Engineer in writing. If required, an updated earthing system shall be provided for the transformer to match the requirements of Engineering Standard SPE-EE-0020 - MV & LV Earthing.

PSE 7.2 Earthing Conductors

(a) Earthing conductors shall be PVC-insulated copper conductors or bare earth copper conductor as indicated, and sized in accordance with the earthing drawings.

PSE 7.3 Earth Continuity Conductors

(a) Earth continuity conductors shall be provided with all LV power cables to electrical equipment as shown on the single line diagrams.

(b) Where no separate earth continuity conductor is shown on the single line diagrams, the intention is that a spare core in the power cable shall serve this function.

PSE 7.4 Bonding

(a) All exposed conductive parts and accessible extraneous conductive parts shall be bonded in accordance with the Engineering Specification SPE-EE-0020 - MV & LV Earthing.

PSE 8 REMOVING OF REDUNDANT EQUIPMENT

PSE 8.1 General

(a) Redundant MCCs, Cables, and other equipment shall be disconnected and decommissioned, and delivered to the Client's store facilities on site.

PSE 9 WORK DONE BY OTHERS

PSE 9.1 LV installation

(a) Small power distribution boards has to be provided if necessary.

PSE 10 Control and instrumentation SCOPE OF WORKS

The scope of works for the electronic installation (Control & Instrumentation equipment) is the design, supply, delivery, installation, testing, commissioning and upholding during the trial operation period and the defects notification period of the following equipment and materials:

(a) Incorporation of all new I/O onto the existing PLC MCC-FP to the site Industrial Network Infrastructure.

(b) Remote I/O panels linked to the relevant MCCs.

(c) Control System Functional Design Specification (describing how the existing PLC will be programmed to meet the new Process Control Philosophy) before programming commences.

(d) Programming of the PLCs

(e) Process Instrumentation

(f) Control and instrumentation cables including data communications cables

(g) Earthing and surge protection for power, instrumentation and control components.

PSE 11 REFERENCE DOCUMENTATION

PSE 11.1 Specifications, documents and drawings

(h) The control and instrumentation installation shall comply with the Zutari Standard Specifications listed below and described further in each section:

(i) Engineering Standard SPE-II-0001 - General Electronic Installations

(ii) Engineering Standard SPE-II-0002 - Programmable Logic Controllers

(iii) Engineering Standard SPE-II-0003 - Industrial Network Installation

(iv) Engineering Standard SPE-II-0007 – Instrumentation

(i) These schedules may be affected by the actual mechanical equipment supplied by the Contractor. Tenderers shall price for any changes to the control and instrumentation design that are caused by their selection and offer of mechanical equipment.

(j) The schedules shall be finalised by the Contractor during the contract and shall be submitted for approval by the Engineer before procurement and manufacture.

PSE 11.2 Contractor's documentation

(k) The Contractor shall submit a detailed control system architecture for the WWTW. The submission shall include all offered equipment and diagrammatic representation (i.e. location on the plant) to the Engineer for approval. The submission shall be prior to detail design, purchase of equipment, manufacture and programming of the control and instrumentation system.

(l) The Contractor shall compile and submit a control system functional design specification (FDS) in accordance with ISA 5.06.1 to the Engineer for approval before any control system configuration or programming takes place.

PSE 12 PROGRAMMABLE LOGIC CONTROLLERS

PSE 12.1 General

(a) The existing PLC installation shall be adjusted to accommodate the proposed equipment.

PSE 13 INSTRUMENTATION

PSE 13.1 General

a) All process instrumentation supplied and installation under this contract shall be compatable to existing instrumentation.

PSE 13.2 Level Measurement

a) The level upstream and downstream of the screen (inlet works) shall be measured. The screen operation shall be based on the differential level measurement. For this installation, two sensors shall be connected to one transmitter.

b) The level inside sumps shall be measured via normal ultrasonic transducer mounted in such a position to prevent spurious echoes or false readings from equipment or pipework inside the sump.

PSE 13.3 Position Measurement

(a) Position limit sensing of equipment shall be implemented by means of electro-mechanical contact limit switches.

PSE 13.4 Installation, Inspection and Testing

a) Instrument transmitters shall be mounted separately from the sensors and shall allow local indication where specified in the Instrumentation List.

b) Instrumentation installed outdoors shall have their transmitters installed in a 316 stainless steel IP 65 weather proof enclosure near the point of measurement. All mounting material and brackets shall be 316 Stainless Steel.

c) Field instrumentation shall be powered from the nearest MCC UPS and connected to the MCCs (through relay interlocks) to provide the required monitoring and control specified in the Control Philosophy and in the Instrumentation List. Instruments for critical pump protection (safety interlocks) shall also be wired to the MCCs (by means of relays logic) to ensure tripping by hardwiring.

d) All instrumentation that is not an integral part of mechanical equipment shall be suppli ed and installed by the Contractor together with all brackets, adaptors and connector s that may be necessary and the price offered for process instrumentation shall be deemed to include for all mounting equipment and ancillaries. The Contractor shall produce instrument hook-up drawings for approval by the Engineer prior to installation.

e) The instruments shall be calibrated and calibration certificates shall be supplied and submitted to the Engineer for review as well as filed in the O&M Manuals.

PSE 14 CABLES AND WIRING

PSE 14.1 General

(a) All cable lengths shall be re-measured after installation, and the quantities in the bill will be adjusted accordingly.

PSE 14.2 Control and Instrumentation cables

(a) The Contractor shall develop a final cable schedule and cable block diagram to suit his equipment offered under the tender.

(b) The Contractor shall allow for sufficient cable lengths for all control cabling required to complete the installation.

(c) Control cables shall be primarily 1.5mm² stranded copper core specific cable, and in the case of hardwired safety devices, 600V, 1.5mm² copper multicore PVC-insulated cables with galvanised steel wire armouring.

(d) Instrumentation cables shall be primarily 1.5mm² twisted pair copper conductor, PVC-insulated with galvanised steel wire armouring and PVC serving.

(e) Unarmoured cables may be used when cables are installed indoors in protected wireways.

(f) The Contractor shall be aware that the WWTW is a harsh environment with H2S gas affecting most metals, all cable glands shall therefore be resistant to this corrosion and shall of the Enviro-gland or approved equivalent type.

PSE 14.3 PLC and Remote I/O data cables

(g) A Fieldbus network shall be installed to connect all the PLCs and remote I/Os.

(h) The following data cables shall be provided for the PLC & Remote I/O network and links to associated equipment:

(i) PLC to PLCs: Armoured Fieldbus cable.

(ii) PLC to Remote IO: Armoured Fieldbus cable.

PSE 14.4 Cable Junction Boxes

(a) Control and Instrumentation cable marshalling junction boxes shall be provided as required.

(b) Cables shall enter and exit the junction box from the bottom and be properly glanded to the bottom of the box, ensuring the IP rating remains intact.

(c) Junction boxes shall be installed in an easily accessible location on a purpose made stand or bracket which is not in the way of maintenance required to equipment in that area.

(d) Junction boxes shall be earth bonded to the nearest cable ladder.

(e) Door locks shall be provided with the lockable square key latches.

(f) Instrumentation with Integral cables shall be terminated to the control or instrument cables via utility junction boxes with screw terminals inside and suitable glanding to maintain the IP rating.

(g) Allowance shall be made for junctions by proxies by means of Utility boxes (i.e. equal or similar to CCG/Pratley).

HESSEQUA MUNICIPALITY

HES-TECH 11/2223

ALBERTINIA WASTE WATER TREATMENT WORKS : REFURBISHMENT :

MECHANICAL AND ELECTRICAL WORKS

ELECTRICAL STANDARD SPECIFICATIONS

Specification	Description
SPE-EE-0010	LV Switchgear & Controlgear Assemblies
SPE-EE-0011	LV cables
SPE-EE-0012	Cable Support Systems
SPE-EE-0025	LV Electric Motors
SPE-II-0001	General Electronic Installations
SPE-II-0003	Industrial Network Installation
SPE-II-0007	Instrumentation

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