Part 3: Scope of Work

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C3.1: Employer’s works Information

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# Description of the *works*

## Executive overview

The Sewage Plant at Matimba Power Station (Nelsonkop Sewage Plant) started operating in the late 80’s. The plant has deteriorated over the years and needs to be refurbished and upgraded. The plant has to be refurbished such that the output qualities obtained complies with Class C of the Water Quality Guideline of the Department of Water and Sanitation. The limits are also stated in the Water Use License (License No. 16/2/7/A400/B21/1) and non-compliance to these qualities may result in revocation of the WUL. Furthermore, the plant has to be upgraded with the latest technologies to ensure that it operates reliably for the next 25 years. The aim is to ensure that process integration is improved and more flexible. The plant was partially refurbished in 2013.

The works is inclusive of all activities necessary for the provision of a fully functional Sewage Treatment plant that meets Eskom and Department of Water and Sanitation requirements. The Contractor designs, manufactures, procures and installs all Mechanical, Civil, Electrical, Control & Instrumentation Plant, Equipment and Material required for the works as defined in this Works Information. This includes interfacing with and utilisation of existing plant and equipment.

The Contractor shall ensure that the complete design shall be performed by, or under the direction, control and supervision of an ECSA registered professional engineer for each discipline as required by the scope of the design. In instances where the design is performed under the direction, control and supervision of a professional engineer, the professional engineer will be responsible for signing off the design as applicable to his/her field of registration.

## *Employer*’s objectives and purpose of the *works*

The objective of the project is to refurbish the entire sewage treatment plant and its associated auxiliaries to comply with the regulations in terms of the Water Act of 1998 (Class C).

Furthermore the purpose of the project is to ensure that sewage plant is upgraded, using latest technological advances to an “as new condition”, able to perform reliably for the next 25 plus years.

To ensure the structure life time expectancy is extended by another 25 years.

The purpose of this document is to describe in detail the scope of supply and services required from the potential Contractors and also describe the technical criteria to which the plant is designed

## Interpretation and terminology

The following abbreviations are used in this Works Information:

|  |  |
| --- | --- |
| **Abbreviation** | **Meaning given to the abbreviation** |
| AFC | Approved for construction |
| Abbreviation | Description |
| AC | Asbestos Cement |
| CAD | Computer Aided Design |
| CoE | Centre of Excellence |
| DB | Distribution Box |
| DFT | Dry Film Thickness |
| DI | Ductile Iron |
| DVD | Digital Versatile Disc |
| EPDM | Ethylene Propylene Diene Monomer |
| FAT | Factory Acceptance Testing |
| FRI | Forecast Rate of Invoicing |
| GRP | Glass fibre Reinforced Plastics |
| HDPE | High Density Polyethylene |
| HMI | Human Machine Interface |
| LDE | Lead Design Engineer |
| LED | Light-Emitting Diode |
| MCC | Motor Control Centres |
| mPVC | Modified Polyvinyl Chloride |
| NB | Nominal Bore |
| P&ID | Process and Instrumentation Diagram |
| PDF | Portable Document Format |
| PE | Polyethylene |
| PFD | Process Flow Diagram |
| PLC | Programmable Logic Controller |
| PVC | Polyvinyl Chloride |
| RAS | Return Activated Sludge |
| SACPCMP | South African Council for Project and Construction Management Professionals |
| SAS | Suspended Activated Sludge |
| SDR | Standard Dimension Ratio |
| SP | Set Point |
| STW | Sewage Treatment Plant |
| UPS | Uninterrupted Power Supply |
| OBL | Outside battery limits |

# Management and start up.

## Management meetings

The *conditions of contract* (e.g. Clause 16.2) require and other sections of the Works Information (e.g. safety risk management) may require (mandate) that a meeting shall be held. However the intention of all NEC contracts is that the Parties and their agents use the techniques of partnering to manage the contract by holding meetings designed to pro-actively and jointly manage the administration of the contract with the objective of minimising the adverse effects of risks and surprises for both Parties.

Depending on the size and complexity of the *works*, it is probably beneficial for the *Project Manager* to hold a weekly risk register meeting (Clause 16.2). This could be used to discuss safety, compensation events, subcontracting, overall co-ordination and other matters of a general nature. Separate meetings for specialist activities such as programming, engineering and design management, may also be warranted.

Describe here the general meetings and their purpose. Provide particulars of approximate times, days, location, and attendance requirements, stipulating that attendees shall have the necessary delegated authority to make decisions in respect of matters raised at such meetings.

The right to hold specialist meetings should be stated generically and in such a way that ambiguity with other parts of the Works Information is avoided.

The following text could be used as a model for this section:

Regular meetings of a general nature may be convened and chaired by the *Project Manager* as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Title and purpose | Approximate time & interval | Location | Attendance by: |
| Overall contract progress and feedback review | Weekly on Thursday at 08:00 | As per meeting notification to be sent | *Employer*, *Contractor*, *Supervisor*, and System Engineer |

Meetings of a specialist nature may be convened as specified elsewhere in this Works Information or if not so specified by persons and at times and locations to suit the Parties, the nature and the progress of the *works*. Records of these meetings shall be submitted to the *Project Manager* by the person convening the meeting within two days of the meeting.

All meetings shall be recorded using minutes or a register prepared and circulated by the person who convened the meeting. Such minutes or register shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the *conditions of contract* to carry out such actions or instructions.

## Documentation control

All contractual communications will be in the form of properly compiled letters or forms attached to e mails and not as a message in the e mail body.

## Health and safety risk management

### General

The *Contractor* complies with the following:

* Matimba Power Station Health and Safety Standards as per Matimba Power Station Health & Safety Specifications for Contractors (PA/270/003) attached to the Invitation to Tender. This procedure will be handed over during tender enquiry and will enable the successful Tenderers to compile a Health & Safety plan that has to be approved by the Employer prior to commencement of work.
* Compliance with Eskom & Matimba No Smoking Policy
* Adhere to the OHS Act 85 of 1993
* All staff will undergo Safety Induction, presented by Matimba Risk Management Department

*Employer’s* site regulations as stipulated in Form PA/270/003, covering the following:

* Clean lines
* Storage of material
* Safety precautions and fire prevention
* Permits to work
* Other *Contractor*'s work
* Representation of sub-*Contractor*s
* Maintenance staff to witness erection
* Supervision
* Handing over of *works*
* *Contractor's* Site

### Matimba Permit to Work System

The *Contractor* will ensure that he/she is informed of all the requirements of Eskom’s Plant Safety Regulations and ORHVS and that he/she at all times comply to the requirements of these Regulations.

The *Contractor* will ensure that all his supervisors who are directly involved with Eskom’s Permit to Work System, are trained and on successful completion of Matimba’s authorization / evaluation process will be authorized as “Responsible Persons”.

The Responsible Person shall ensure that:

* The conditions of permits and cautionary notices are strictly adhered to
* The lockout procedures, mechanical as well as electrical, are strictly adhered to and any deviations shall be corrected immediately
* The safe work procedures as laid down by Matimba Power Station and as determined by the Risk Assessment, shall be followed
* The workers register and cautionary notices are discussed daily with workers

## Environmental constraints and management

### Hazardous Waste

All waste introduced to and/or produced on *Emp*loyer's Premises by the *Contractor* for this order, must be handled in accordance with the minimum requirements for the Handling and Disposal of hazardous waste in terms of Government Legislation as proclaimed by the Department of Water Affairs and Forestry 1994 Ref.: BN0621-16296-5. (A copy of this document is available at the Power Station for reference purposes).

### Environmental Management

Matimba has an Environmental Policy, PP/240/001, to which the *Contractor* and his employees must adhere. It is the responsibility of the *Contractor* to ensure that he obtains copies of the Matimba Environmental Policy, the legal register applicable to his area of responsibility, the aspect register and the Matimba procedures (applicable to the *Contractor’s* area of responsibility) and to familiarize themselves on such procedures, within 30 days from the date of commencement of work at Matimba, to assist the *Contractor* and his/her employees to prevent pollution and to comply with legislative requirements. Copies of the above-mentioned documents shall be obtained from the *Project Manager* or Environmental Officer on the first day prior to commencement of work at Matimba. The *Contractor* shall submit proof to the Environmental Officer of Matimba that he and his employees has done all the necessary training on procedures and Policies supplied to them and that they do understand the contents of the procedures, registers and policies and will adhere to them at all times.

The *Contractor* adheres to the following rules:

* Provide sufficient storage containers, labelled depicting general or hazardous waste and store in a designated storage area
* No hazardous waste may be stored for a period of more than 90 days on the Matimba premises
* Ensure that all hazardous waste is disposed off at a licensed Class H disposal site. A copy of the hazardous waste disposal certificate is submitted to the Project Manager.
* Ensure that all other general waste is disposed off at the local municipal waste dump
* Ensure that the *Contractor’s* site does comply with the general good housekeeping practices. Redundant materials are moved to allocated sites. No scrap shall be stored in the *Contractor’s* yard. Scrap is to be cleared from Site daily.

The non-adherence to the Matimba Environmental policy and rules could result in the termination of this contract.

## Quality assurance requirements

The Contractor submits a quality control plans prior to commencing work. The quality control plans should cover inspections and test proposals for items or activities to be supplied in the contract. The quality control plan indicates the following:

1. The identification of the activity/operation
2. A list of sequence of operations including inspections and tests
3. The identification of the specification, drawing or procedure for each operation
4. The acceptance criteria with reference to the appropriate technical specification set out by the Contractor
5. The inspections and test the Contractor has nominated for hold and witness points
6. Provision for inspections and tests nominated by the Employer, and /or his representative
7. Inspection and test records which are generated by the Contractor

The *Contractor* is also responsible for the following:

1. The Contractor notifies the Employer of any changes to the quality system and obtains agreement prior to the implementation on the existing orders and contracts or sub orders and contracts.
2. Identifies any additional documents which are to be submitted to the Employer
3. Indicates the interface with the Contractor’s quality system and applicable documents such as procedures and work instructions
4. In case a Sub-Contractor is employed, the Contractor indicates how they will be monitored.
5. The Contractor and/or Sub-Contractors give access to the Employer or his representative where appropriate to their premises and facilities at reasonable times to conduct quality assessments, audits, surveillances, and inspections to establish compliance with the contractual requirements.

## Programming constraints

A schedule for the execution of the works shall be compiled in detail and include all work activities.

Schedule to be compiled with MS Projects and presented to the project manager within one week of contract placement for review and approval.

## *Contractor*’s management, supervision and key people

The Contractor shall provide full time supervision while staff is working on the Contract.

The person nominated by the Contractor to supervise the works shall have the authority to take instructions on behalf of the Contractor and shall be registered as a SACPCMP Professional Construction manager with a minimum of five years experience.

## Invoicing and payment

Within one week of receiving a payment certificate from the *Project Manager* in terms of core clause 51.1, the *Contractor* provides the *Employer* with a tax invoice showing the amount due for payment equal to that stated in the *Project Manager’s* payment certificate.

The *Contractor* shall address the tax invoice to Eskom Holdings SOC Ltd and include on each invoice the following information:

* Name and address of the *Contractor* and the *Project Manager;*
* The contract number and title;
* *Contractor*’s VAT registration number;
* The *Employer*’s VAT registration number 4740101508;
* Description of service provided for each item invoiced based on the Price List;
* Relevant Purchase Order number;
* Total amount invoiced excluding VAT, the VAT and the invoiced amount including VAT;
* Invoices to be submitted to InvoicesEskomLocal@eskom.co.za and the Project Manager

## Contract change management

Standard NEC forms to be used in the event of any possible compensation event claims.

# Engineering and the *Contractor*’s design

## *Employer*’s design

### Process Description

The existing treatment works receives its influent from Marapong Township and pump station 3 situated next to Medupi housing village. The plant currently has a biological treatment capacity to accommodate a population of 10 000 persons and a hydraulic capacity of 1.2 Ml/day. The purpose of this refurbishment is to maintain the capacity of the plant to receive 2.7 Ml/day as per the original design.

The existing plant consists of an inlet works with a hand raked screen, an aerated balancing tank, an activated sludge reactor, a secondary settling tank and a chlorine contact tank. An inter-stage pump station forwards flows from the aerated balancing tank to the activated sludge reactor from where it flows via gravity through the remainder of the plant. Return Activated Sludge (RAS) is returned to the activated sludge reactor via a sludge pump station. Waste Activated Sludge is forwarded to a series of drying beds via the same sludge pump station. Disinfection is in the form of chlorine gas dosing. A Process flow diagram and P&ID (20.58-14933) of the existing Plant Process is included (Drawing No: 0.58/380).

The proposed upgrade to the works is focused on increasing biological performance of the plant. Biological capacity is increased by converting the aerated balancing tank into an activated sludge tank and by decreasing the pumping rate of the transfer pumps and also introducing DO and pH meter in the activated sludge tank. In order to convert the aerated balancing tank into an activated sludge reactor, the RAS needs to be returned to the aerated balancing tank.

### Process Data

#### Design Raw sewage qualities

|  |  |  |
| --- | --- | --- |
| **PARAMETER** | **Units** | **Design Value** |
| Ammonia Nitrogen (NH3-N) | ppm | 30 |
| COD | ppm | 400-700 |
| pH | N/A | >6.5 |
| Settle able solids | Ml/l | >5 |
| Suspended Solids | ppm | >40 |
| TKN | ppm | 65 |
| Total Phosphate |  | 7 |

#### Hydraulic Capacity

The hydraulic capacity of the plant is to be increased to cater for an average dry weather flow of 2.7 Ml/day.

#### Biological Load

The biological load capacity of the plant is to be increased to cater for a BOD load of 845 kg BOD /d and a nitrogen load of 185 kg/d.

#### Treatment Standard

The extended scheme has been designed to produce an effluent that complies with the General Limit Values as defined in the Water Act, the principal parameters of which are:

|  |  |
| --- | --- |
| COD | 75 mg/l (max.) |
| Ammonia as N | 6 mg/l (max) |
| Nitrate as N | 15 mg/l (max |
| Suspended solids | 25 mg/l (max) |
| pH | 6.0 – 9.0 |
| E Coli | 0/100 ml |
|  |  |

### New/Proposed Operational Philosophy

The sewage treatment plant receives sewage from Pump Station 3 and Medupi housing village. The inlet chamber will be equipped with an automated screen. The screen consists of a vertical perforated screen basket and a shafted augur in a vertical tube. The sewage flows thorough an inflow connection and a chamber into the screen basket. Within the screen basket the flights of the screw are equipped with wear-resistant brushes for effective cleaning of the screen. As the screenings are gradually elevated by the augur, they are dewatered. The compacted screenings are discharged into a container/skip. The screened sewage flows off by gravity into the pump sumps. The top of the inflow chamber is open and serves as an emergency bypass so that the machine can be submerged without problems in case of power failure. The integrated bottom step prevents back-flooding into the sewer system and thus undesired deposits into the incoming sewer. The inlet chamber also has an overflow pipe into the pump sumps to prevent overflow of the inlet chamber. There will be two submerged pumps. The first pump will start 6m below ground level, second pump will start 5m below ground and pumps should stop 8m below ground level.

Raw sewage from Marapong and Pump station 3 is pumped to the inlet works at the Nelsonkop sewage treatment works via two rising mains. Two flow measuring devices are equipped on the two rising mains at the Nelsonkop Sewage Treatment plant inlet.

The raw sewage then flows through the inlet channel equipped with two electro-mechanical screens. One of electro-mechanical screens will be operational while the other one is on standby. While the raw sewage flows in through the open front end of the screen basket and through the screen bars, solids are retained by the screen basket, whereby the separation of floating, settling and suspended solids is dependent upon the screen bar size. Blinding of the screen surface generates an additional filtering effect so that solids can be retained that are smaller than the bar spacing. The machine starts to operate when a certain upstream water level is exceeded due to screen surface blinding. A robust stainless steel screw removes the screenings from the screen basket surface. Additional cleaning is achieved by wear-resistant brushes fitted to the screw flights. The screw conveyor transports the screenings through a closed and inclined pipe. While the screenings are transported, the screw conveyor dewaters and compacts to discharge them into a skip/container.

The raw sewage then flows through two constant velocity grit channels. Once raw sewage is screened and de-gritted it gravitates into the balancing pond. Pre-aeration and flow balancing takes place in the Balancing pond. Pre-aeration equipment comprises two free standing submerged aerators, free standing on the bottom of the pond, which provide sufficient oxygenation to reduce the estimated BOD (Biochemical oxygen demand) load by approximately 30%. The purpose of aeration is to suppress sewage odours and to maintain solids in suspension. The aerators are operated either individually, or simultaneously. The operation of the floating aerators is controlled automatically with a manual programmable timer with manual over-ride on the local stop/start control panel. The balancing pond is equipped with mercury float level controls to start the transfer pumps when the desired level is reached and stop when the desired low level is reached.

Once the balancing pond reaches a certain level one of two newly installed (2) Gorman Rupp pumps are activated by means of mercury float balls connected to the pumps. The raw sewage is then transferred to the aeration tank at a constant rate of 12 l/s. The pumps operate one duty/one standby on HAND/OFF/AUTO control in the local control panel. Mercury float level switches will be pre-set to allow the duty pump to run between low and high settings. The pumps are assembled on steel baseplate complete with ‘V’ belt drive and safety guard. The old pumps should also be connected to assist during high peak flow to avoid overflow of the balancing pond.

A manually raked screen angled at 45º is installed in the inlet chamber to the aeration tank. The pumped sewage from the transfer pump station is discharged just ahead of the screen to remove any additional solids. Collected solid matter on the screen must be raked up on to the drainage tray. The screen must be raked at least once per shift.

The mixed liquor level in the aeration tank varies over a pre-set range, providing a constant flow to the rest of the plant. If the level in the aeration tank reaches the lowest safe working operating level of the transfer pump, then the pump is switched off by level control device installed in the aeration tank to prevent overflow. Pump service resumes at the normal operating level.

The two vertical surface turbine aerators provide the means to aerate the sewage and keep the contents of the aeration tank completely mixed at all times. The strong turbulence, allows close contact of the raw sewage and the purifying bacteria. Dissolved oxygen level should be maintained at between 1, 0 and 2,0mg/l for optimum operation of the aeration system. This is normally done by making use of the aeration timing controls to match peak inflow periods.

The average hydraulic retention time at average dry weather flow is approximately 14 hours. The solids retention time at a mixed liquor suspended solids, concentration of 4000 mg/l is approx. 19 hours.

The aerators may be controlled manually or automatically by means of a 24 hour timer switch situated in the main control panel. The auto timer can be set for aerators to run independent of each other for any required period to within a half hour. The running periods for the aerators can be set on auto timer control to coincide with peak flow periods. The mixed liquor overflows into an outlet chamber from the aeration tank to the secondary settling tank by gravity. Mixed liquor from the aeration tank passes over the control weir and into the clarifier through the centre column and out through inlet ports to the main settlement area of the tank. Settled sludge is scraped to the centre-concentrating hopper in the floor of the tank by means of rotating scraper and is displaced through a pipe to the return sludge sump. The sludge discharge rate is variable by means of a series of discharge pipe rings fitted to the outlet end of the vertical sludge pipe. The rings which are self-locating will vary the height of the sludge pipe and will therefore vary the sludge draw off rate. The sludge discharge rate should be approximately 100% of the plant average dry weather flow rate (22l/sec.) Sludge from the sludge sump is returned to either the balancing pond or aeration tank by means of a submersible pump where it is used to maintain the necessary concentration. It will depend on the operational requirement at the time if the Return activated sludge flows into the balancing tank or if it will flow into the aeration tank. The selection between the two tanks is done manually with outlet valves to each tank. Excess sludge must be extracted at regular intervals approximately once a week during operation.

Surface floating matter is removed by the scum skimmer sweeping the scum to a scum outlet box, from where it is discharged to the return sludge sump by the automatic operation of a plug type valve operated by a striker bar on the rotating bridge every revolution of the tank. Clear water overflows the serrated weir plate into the outside launder and is discharged through a short pipe to the chlorine contact tank. A baffle plate prevents surface matter overflow. Weir and baffle plates must be kept clean by regular scrubbing and washing.

From the chlorination tank, the clarified water flows to the maturation pond for final polishing and storage prior to discharge from the treatment plant.

The rate of discharge of the activated sludge from the settling tank to the return activated sludge pump station is controlled manually, by means of a variable level outlet. The activated sludge pump station is equipped with two submersible pumps in a duty/standby configuration. The activated sludge pumps are operated by level controls (float switches) with manual over-ride on the local stop/start control panel. Submersible pumps are controlled float valves and have a low, high and high-high switch.

The activated sludge can be pumped to the sludge drying beds with the activated sludge pumps. This is controlled manually.The waste activated sludge is drained and air-dried on the duty sludge drying bed before manual removal and disposal off site.

An aqueous chlorine solution is mixed with the effluent at the influent of the contact tank. Potable water from the potable water head tank (located on site) is utilized for the aqueous chlorine solution and the chlorine is stored in chlorine gas cylinders in a chlorine building on site. Potable water is pumped through an injector and chlorine gasses are injected into the water, diluting it into a chlorine mixture and dosed into the chlorine contact tank. The effluent passes through the chlorine contact tank, flow over a weir where the flow is measured. Then effluent flows into the maturation pond 1 by means of gravity. It flows into the outlet chamber and gravity feeds to the maturation pond 2. At Maturation pond 2 the water is pumped to site for irrigation purposes or to the recovery dams when the required specification is not reached. The potable head tank is equipped with a float valve so that when full its shuts off the supply to the tank.

## Parts of the *works* which the *Contractor* is to design

The Contractor is responsible for carrying out all activities and supplying everything necessary to provide the Works in accordance with the requirements of this Works Information. An organogram of the entire project team shall be submitted with the tender. The CVs of ECSA registered engineers per engineering discipline should be submitted and contain a copy of the ECSA certificate.

The short description of the scope of work for this project includes the design, construction, supply, delivery, installation, commissioning and decommissioning of the civil, mechanical, electrical, control & instrumentation for the refurbishment of STP. The works includes:

1. Two automated screens on duty/stand-by operation for channel installation as well as the design and construction of these channels.
2. Two inline magnetic flow meters for Marapong and Pump Station 3 inlet flows.
3. Two submersible Aerators in the balancing pond
4. Inter stage pumping station including all the pipes, valves and level regulators necessary.
5. Two Mixers to be mounted on the existing structure of aeration tank during structural repairs.
6. One DO analyser (aeration tank), two pH meter (balancing pond inlet and aeration tank) and one Chlorine residual analyser (outlet of contact tank).
7. Inspection of the mechanical components of the settling tank and all worn out mechanical parts of to be supplied and installed.
8. Replacement of all the existing asbestos pipes as well as the valves installed on those pipes.
9. Two return activated sludge pumps and necessary valves and piping.
10. Chlorine dosing system refurbishment to comply with SANS 10298:2009 (Indirect small to medium-sized gas chlorination systems for the disinfection of water)
11. Inspection of Concrete structures with full technical report as well as the repairs of defective structures:: The balancing pond, aeration pond, settling tank, chlorine contact tank and drying beds show extensive concrete corrosion
12. Replace the six (6) drying beds sand
13. Laboratory refurbishment
14. Pump Station 3 refurbishment
15. Raw and treated sewage pipe line inspection and a full technical report
16. All necessary control panels
17. MCC
18. Provision for an alternative raw sewage handling and treatment during Work execution (needed for the duration of the Works execution) period. The plant should be able to treat 1.5 Mega litres per day.The Contractor will provide the Client with a proposal for this for approval before commencement of the contract. This is to form part of the method statement package supplied in the tender.

### Detailed project specifications of works

#### Installation of pump station screen at Pump Station 3

One new Pumping Station Automated Screen shall be supplied and installed under this contract. Civil and mechanical modification of the inlet chamber will be required to accommodate the new screen. The new screen must allow combination of screening, transport, compaction and dewatering in a single unit.

The strainers will be manufactured from 316 stainless steel with frost protection and shall comply in general with the following:

1. The screen is to be supplied complete with electrically driven motors, electrical cabling, and electrical control panel required.
2. All the necessary control panels with minimum start stop buttons must be supplied. The screen systems will be controlled from these local panels. The replacement must conform to Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Material and Structures Manufactured from Steel (240-75655504).
3. The current sewer inlet pipe does not have a flanged end connection, it will need to be modified as screen connect to the sewer pipe by means of a flanged joint. The sewer inlet pipe is 300NB.
4. The inlet chamber is 1750mm in diameter and 5 m deep. It will require a new lid as the current lid is different. The inlet chamber will also need to be cleaned and repaired before any installation can take place.
5. Contractor to size the strainers for the flow rate of 85 l/s.
6. The screen basket diameter 500 mm.
7. The discharge shall be high enough to fit over a skip or waste bin to collect the discharged solid waste.

#### Pump Station 3 further scope

All the sumps at pump station 3 needs to be pressure washed to remove accumulated sludge in the sumps.

Within this work package, the Contractor shall make allowances for replacement of pump guide rails of the following pump model:

The pump type FYLGT model CP3201.180 or equivalent as this model might be obsolete. The pumps must be upgraded with a guide-pin and flush valves (4901 model). Note Eskom will provide the flush valve

The submersible pump shall have the following features:

1. Be installed in the existing sump after the sump are pressure cleaned.
2. Be fitted with mercury float level control for level control between low and high.
3. The sump should be fitted with guide bars and upper guide bar holders for three pumps. 3’’ Guide bars with a length of 7.75 m (double standard pipes)
4. Be able to be operated manually on the current local control panel.
5. Provision for alternative sewage handling during work execution. There should be a way to transport raw sewage from the pump station to STP during work execution at pump station 3.

#### Replacement flow meters

The flow meters at the inlet of the Sewage plant needs to be replaced. The tender unit shall be Sum and the rate shall be all-inclusive.

There are two Polyvinyl Chloride (PVC) pipes coming in from Marapong and another from Pump station 3. Currently the pipes ties into the manual screen at the plant with two mag flow meters connected on the lines. The flow meters needs to be replaced and installed on the existing pipelines.

**Flow meter specification:**

Type: magnetic flow meters

Flowrate: 160 l/s

Pipe material : PVC

Pipe sizes: 350 mm and 200mm

#### Installation of micro strainers (duty/stand-by operation)

A new automated micro strainers for channel installation shall be supplied and installed under this contract. Civil modification of the inlet channel will be required to accommodate the strainer. The new strainers must allow combination of screening, washing, transport, compaction and dewatering in a single unit. The tender unit shall be Sum and the rate shall be all-inclusive.

The strainers will be manufactured from 316 stainless steel with frost protection and shall comply in general with the following:

1. The screen is to be supplied complete with electrically driven motors, electrical cabling, and electrical control panel required.
2. All the necessary control panels with minimum start stop buttons must be supplied. The strainer systems will be controlled from these local panels. The replacement must conform to Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Material and Structures Manufactured from Steel (240-75655504).
3. The strainers must have an integrated screenings washing systems.
4. Channels will need to be constructed for installation of the strainers, inlet pipes and outlet pipes to the grit channel. This modification will need to go through the approval process and all the required documents provided before any work can commence.
5. The discharge shall be high enough to fit over a skip or waste bin to collect the discharged solid waste.
6. Contractor to size the strainers for the flow rate of 160 l/s.
7. Each strainer size 700 mm with 3 mm perforated plates. Inlet channels to be 700 mm wide and 900 mm deep as a minimum.

#### Installation of two floating aerators in the balancing tank

Two free standing submersible self-aspiration aerators shall be supplied and installed under this contract. The tender unit shall be Sum and the rate shall be all-inclusive. The balancing pond has a net volume of 1130m3 sized 16m x 32m at the bottom with 45⁰ sloping sides.

The aerators shall be manufactured from proven designs and shall comply in general with the following:

1. Each aerator is to be supplied complete with electrically driven motor, polyurethane filled Glass fibre Reinforced Plastics (GRP) float and mooring ropes.
2. The electric motor is to be of the type specifically designed for aerator duty with non-hygroscopic windings and a one piece stainless steel shaft.
3. The float shall be constructed of GRP and shall have an integral volute reinforced with encapsulated steel.
4. The electrical motor shall be supported on a galvanized mild steel support ring.
5. The aerator shall be fitted with a precision cast stainless steel impeller with 180-degree tailback blades designed to minimize clogging.
6. The current aerators are moored by three-point tie-off shore point method. The selection of the mooring cables should be in accordance with the manufacturer’s suggested standards. The length should be sufficient to allow for variation in vertical movement of the aerators with liquid level change. All mooring cables and hardware should be stainless steel.
7. Local electrical control panel with minimum start stop button must be supplied. The aerators shall be able to be controlled manually or by means of a timer from the panel. The replacement must conform to Corrosion Protection Standard for New Indoor and Outdoor Eskom Equipment, Components, Material and Structures Manufactured from Steel (240-75655504).

**Specification of existing aerators:**

Air inlet bore = 80 mm

Air quantity= 260 Nm3/hr

Max Water depth = 4.7

#### Inter-Stage Pumps (Transfer Pumps)

Two inter-stage pump sets are required in a duty/standby configuration. The installation includes two suction and delivery pipework complete with non-return valves and shut off valves.

The contractor shall provide design calculations, construction drawings, P&ID’s and further required drawings prior to commencing procurement and installation.

The pumps shall be mounted next to the existing inter-stage pumps and should be self-priming. The old pumps should be connected to the system such that when the level is very high in the balancing pond, one of the existing pumps should kick in to assist the two small pumps.

The pumps shall be “Gorman – Rupp T8A-B” or similar and shall have the following features:

1. Horizontal Centrifugal pumps
2. 1150 rpm, 5.5 Kw drive motors with belt drives
3. 100mm galvanised suction and delivery pipework flanged
4. Delivery single door swing non-return valves and shut-off (gate valve) valves 100mm flanged
5. Be mounted on a common base plate with the motor
6. The base plate will be bolted to a concrete plinth
7. 3 mercury float switches for level control
8. Be connected to the ultrasonic level indicator to achieve the control on flow rate required. The ultrasonic level indicator is connected to the aeration tank level to ensure that it does not overflow.
9. Systems should be equipped with a local control panel with selection between manual and automatic operation. It should also be equipped with duty selector to select between pump 1 and pump 2. Automatic operation would be stop-start based on high-high and low level in balancing dam. The pre-set level of the balancing dam should allow for constant flow to the aeration tank without stop, start running of the pumps.
10. Pump failure should be indicated by a highly visible flashing red light.
11. The pumping facility should have the necessary rigging installations such as gantries of jib beam to be used for maintenance purposes.

The required delivery range is as follows:

1. Maximum delivery 14l/s
2. Minimum delivery 12l/s
3. The static head will vary from 1.8 m to 2.0 m

The rising main is a 100 NB steel pipe, approximately 10 m in length on the discharge and 10 in length on the suction to the inter-stage pumps

**Note:** There are two suction mains (one per pump) and a single common rising main

#### Mixers in the aeration tank

Two high-speed fixed mixers shall be supplied and installed under this contract. The surface aerators the employer proposes will be mounted onto the existing concrete bridge which spans across the aeration tank. The mixers should be installed after the concrete repairs are done. The dimensions of the aeration tank are 25m x 16m x 3.6m.

The mixers shall be manufactured from proven designs and shall comply in general with the following:

1. Each mixer is to be supplied complete with electrically driven motor.
2. The electric motor is to be of the type specifically designed for mixer duty with non-hygroscopic windings and a one piece stainless steel shaft.
3. The electrical motor shall be supported on a galvanized mild steel support ring.
4. The aerator shall be fitted with a precision cast stainless steel impeller with 180-degree tailback blades designed to minimize clogging.
5. The mixers shall be controlled manually and by means of a timer.
6. The mixers shall be connected to a local electrical control panel as specified hereinafter with stop/start facility.

**Specifications of Existing Mixers:**

Electromotor: 22kw/1450 rpm/4 pole/380V/3 phrase

Driven motor coupling to gearbox flexible coupling in lantern housing assembly

Gearbox coupling to aerator shaft rigid spigoted flanged coupling

Hansen gearboxes type ND 36, shaft arrangement AN, reduction ratio 25:1

Rotation speed of aerator: 57 rpm

Immersion depth of aerator: +50mm

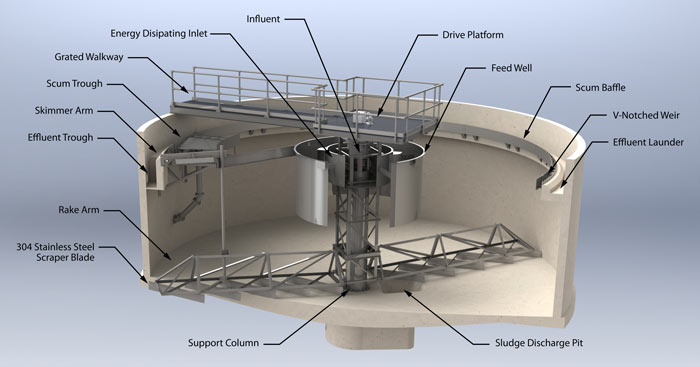
Power absorbed at shaft: 20kw

O2 capacity: 2.05 kg O2/Kwh

Nominal O2 capacity: 82 kg O2/hr

#### Settling tank mechanical refurbishment

The settling tank (also known as a clarifier) mechanical bridge is showing extensive wear and needs to be refurbished to as new condition. With a continuous flow of effluent water into the clarifier it is difficult to estimate the extent of the damage is on the bridge, supports, and civil structure. Thus the tendered price shall be for worst case scenario and needs include all mechanical works on the clarifier to be refurbished to a new condition. Pressure cleaning of the clarifier should also be included. The clarifier has a diameter of 14 meters with pheripherical launders and water depth of approximately 5m.





### Replacement of Asbestos pipes on the RAS/SAS system

The return activated sludge (RAS) pipework was replaced before commencement of the new contract. The old Asbestos pipe is still on site and needs to be removed in a safe manner. Only an approved dump site, for the removed material, may be used. Approval of the method statement and dump site is to be given by the contractor before any removal of material from site. The pipes of SAS system that delivers SAS to the drying beds are currently asbestos. These pipes need to be replaced with HDPE pipe, and asbestos need to be disposed of in a safe manner.

**The specification for the new pipe to be installed is as follows:**

* HDPE 100 SDR 17 (Class 10) – 100NB
* All old valves to be replaced with gate valves of 100NB

\*The Contractor shall be responsible for the excavation, removal, and disposal of the old AC pipe on a licensed landfill site as well as the supply, installation and backfilling of the new HDPE pipe.

The pipe that transfers sewage from aeration tank to the clarifier as well as the pipe that transfers sewage from the clarifier to the sludge sump is asbestos. These pipes are encased in concrete and cannot be removed. The Contractor will be required to high-pressure clean the pipes and conduct a CCTV camera inspection of the pipes. The results of the inspection will be submitted to the Employer in the form of a technical report. If the pipes are found to be severely deteriorated the Contractor will repair the pipes by lining them with a suitable epoxy liner. Care shall be taken to ensure that the lining does not adversely affect/restrict the flow in the pipes.

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All asbestos related work shall be done in accordance with Eskom Standard 32-303: *Requirements for safe processing, handling, storing, disposal and phase-out of asbestos and asbestos containing material, equipment and articles* and the *Asbestos Regulations, 2001*. Only registered asbestos contractors who are registered with the Chief Inspector will be allowed to conduct any asbestos related work.

#### Online Analyser Supply and Installation

Various online analysers are needed to ensure continues monitoring and operation at optimum conditions. In order for plant to operate under optimum conditions, various parameters like MLSS, oxygen level, BOD, pH, free chlorine are essential.

The Contractor will conduct a survey of the facility and submit a priced list of equipment needing.

An indicative list of online analyser equipment is as follows:

1. Oxygen analyser in the aeration tank.
2. pH meter in balancing dam and contact Tank
3. Residual chlorine analyser in contact pond

The analysers shall be online analysers and should also have a local display

#### Chlorine Dosing System Refurbishment

The complete chlorine dosing system shall be refurbished and upgraded under this contract and shall include a new chlorine detector and audible alarm to monitor for the presence of chlorine gas in the room. The chlorine dosing system needs to be refurbished so that it complies with SANS 10298:2009 (Indirect small to medium-sized gas chlorination systems for the disinfection of water) and also should be able to run on auto for effective and efficient chlorine dosing purposes. The chlorine system at the Water Treatment Plant for potable dosing can be used as reference for the sewage plant project. The water treatment plant chlorine dosing system drawings will be are available for reference. The point of chlorination must be moved to the inlet of the contact tank to allow for longer contact time before discharge to maturation pond 1. The contractor shall provide design calculations, construction drawings, P&ID’s and further required drawings prior to commencing procurement and installation.

Supply and install one outlet flow meter for chlorine contact tank.

As a minimum requirement the system should have the following:

* Chlorine detector
* Audible alarm
* Automatic switch from empty chlorine bank to full chlorine bank

#### Drying beds sand

The sand and gravel in the drying beds (x6) shall be removed, disposed of in an approved disposal facility, and replaced with new sand. Each drying bed is 100m2.

The drying beds will be thoroughly cleaned, the bottom distribution system and laterals will be inspected, and a proposal shall be provided to Employer for any repairs needed.

The sand and gravel charge will be as follows:

* Graded gravel to be placed around the bottom drains in layers up to 30cm with a minimum of 15cm above the top of the bottom drains. At least 3 cm of top layer should consist gravel of 3 to 6mm size
* Clean sand of effective size of 0.5 to 0.75mm of uniform coefficient not greater than 4 to be used. The depth of sand may vary from 20 to 30cm.

The tender unit shall be m3 and the rate shall be all-inclusive of transport, removal, and replacing.

## Procedure for submission and acceptance of *Contractor*’s design

* + 1. **Design Review**

The design documentation shall be submitted to the Project Manager four weeks after the Contract Date. The Project Manager approves or rejects six weeks after the design is submitted

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All design work is signed and approved by the applicable Professional Engineer (Mechanical, Electrical, Chemical, and Civil) responsible for their preparation before being submitted to the Project Manager.

The Contractor submits detailed Technical Data Sheets of all mechanical equipment used for the works to the Project Manager as part of the design.

Approval of the design by the Project Manager does not relieve the Contractor of his liability for his design.

* + 1. **Documentation submission and recording**

The Contractor establishes a document tracking system to record the dates for the supply and receipt of all design drawings, calculations, requests for information and design documentation

The Contractor submits to the Project Manager a schedule within one month of the starting date of all documents for acceptance. This schedule provides individual titles of drawings and calculations, and their proposed submittal dates, for submittals as requested in the Works Information and as necessary for the review by the Project Manager of the proposed means of compliance by the Contractor with all aspects of the requirements of the Contract. The scheduled date of first submittal, time allowed for acceptance and expected date of issue after acceptance will be shown for each drawing or document

The following documentation shall be supplied for the requirements of this Works Information from the Contractor in the final design package before any construction or commissioning commences.

1. Document submittal schedule indicating when all documents will be submitted
2. Drawing Register indicating when drawings will be submitted.
3. Complete detailed design file including all design calculations.
4. Functional Specifications
5. Line Sizing Calculations and Material Selection
6. Final isometric and general arrangements illustrating pipe dimensions, pipeline layouts and showing pipe supports
7. General Arrangement Drawing of System and boundaries (for the plant, control panel for trace heating and electrical panel)
8. Piping and Instrument Diagrams
9. Component material datasheets
10. Quality Control Procedures
11. Quality Control Plan and Inspection and Test Plan
12. Method Statements
13. Commissioning procedures
14. Assembly procedures
15. Technical, Operation and Maintenance Manuals of all plant equipment
16. Operating and Control Philosophies
17. Maintenance Philosophy
18. System curves and pump curves (for applicable motive water pumps)
19. Updated P&ID’s with KKS coding
20. Loop Diagrams
21. Field termination drawings
22. Pipeline Schedule
23. Instrument schedule
24. Drive and Actuator Schedules
25. Mechanical Hook-up diagrams
26. Electrical Hook-up diagrams
27. I/O block diagrams
28. LOSS diagrams
29. Cubicle Internal Equipment Schedule
30. Functional Distribution (Allocation of field devices to I/O)
31. Detailed I/O List and Channel Assignments
32. Cable schedules
33. Termination schedules
34. Instrument calibration certificates
35. Valve datasheet
36. Schematics for the electrical design
37. Critical Spares List
38. Welding Procedure Specifications
39. Welding Procedure Qualification Record
40. Operating, Maintenance and Engineering Training Manuals

## Other requirements of the *Contractor*’s design

1. In designing the works, the Contractor takes due cognisance of existing plant and equipment as well as safety and housekeeping constraints. It is the responsibility of the Contractor to overcome any issues that may arise due to space constraints with prior consent from project management and no extra payment or claim of any kind will be allowed on account of difficulties of access to the works or for the requirements of working adjacent to or in the same area as others. Adequate working space shall be provided by the Contractor for all new plant and existing plant for inspection, testing, operating and maintenance purposes.
2. The Contractor is fully responsible for integrating his design with the existing installed plant and equipment. The works shall comply with professional engineering practice and standards. The works shall be designed for the environmental conditions prevailing at Matimba Power Station Site.
3. The Contractor lists all the consumable components that forms part of the works, specifies each components life and includes it as part of the design package.
4. All Plant and Materials used for process control are constructed of suitable material so that no corrosion or erosion by chemicals can occur, by virtue of its installation in the process.
5. The Contractor provides all relevant welding procedures for acceptance by the Project Manager.

## Use of *Contractor*’s design

All designs, drawings, specifications, instructions, manuals and other documents created, produced by or on behalf of the *Contractor* for the purposes of Providing the *works* (collectively, the “Contractor’s Copyright Documents”) and copyright therein and all intellectual property rights relating thereto, are, will be, and will remain the property of the *Contractor*.

The *Contractor* hereby grants to the *Employer*, with effect from the Contract Date or in the case of documents or other matter not yet in existence, with the effect from the creation thereof (and notwithstanding the Completion or abandonment of the *works* or termination of this Agreement) an irrevocable, royalty-free, non–exclusive and perpetual licence to use those of the *Contractor’s* documents and other matter supplied to the *Employer* under this contract, for any purpose whatsoever connected with the *works*, including for the purpose of maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the *works* or any parts thereof. The *Contractor* hereby shall procure that each *Subcontractor* shall execute all and any documents or other matter and take any other actions as may be required in order to give effect to this licence.

The *Employer* uses the *Contractor’s* Copyright Documents and all intellectual property rights relating thereto for the sole purpose of all its needs at Matimba Power Station, which includes any *Employer* processes and procedures pertaining to use, maintenance, operation, construction, retrofit, refurbishment, upgrade, repair or demolition of the *works*.

The *Employer* may copy and submit, without restriction, all documentation to others employed or contracted by the *Employer* who has duly signed a confidentiality agreement with the *Employer*.

The *Contractor* may not use any Copyright Documents (and the copyright therein and all intellectual property rights relating thereto), which are owned by the *Employer* and/or *Others* and provided to the *Contractor*, for any other purpose than to Provide the *works.* The *Contractor* may not copy and therefore not retain copies of any such Copyright Documents.

At Completion of the whole of the *works*, or earlier termination, the *Contractor* returns to the *Employer* all such documentation provided to him by the *Employer* and/or *Others*.

### Intellectual property

The *Employer* shall be granted, upon full payment, the non-exclusive right to the intellectual property necessary for the use and the operation of the *works.*

## Design of Equipment

The contractor shall provide a detailed proposal of the alternative treatment plant to be used. The treatment system should be able to handle 1.5 Mega litres per day. The dimensions shown on the tender drawings are intended for tendering purposes only. The Contractor is required to take the actual measurements onsite before proceeding with design & manufacture, as dimension accuracy remains the responsibility of the contractor.

Contractor’s design or proposed design of alternative treatment plant are to be shared with the Project Manager, not necessarily for his acceptance but as an assurance that the plant will be able to allow the Contractor to Provides the Works efficiently and without delay. The liability of such design and use of the Equipment remains with the Contractor. Dimensions of every process unit to be submitted.

• Proof that the Alternative treatment plant/system can produce the required effluent quality. Supplier to provided 3 months analysis sheets of the effluent quality that a similar plant produced, the analysis sheets provided should show the company or owner of the plant and dates.

Refer to 6.3.7 of this works information for detailed requirements of the alternative treatment stream/system.

## Equipment required to be included in the *works*

The contractor shall supply all the equipment mentioned in sections 3, 5&6 of this works information

The Contractor shall supply all of the equipment for the civil inspection and repair. This shall include as a minimum:

1. All mobile pumps and holding containers required to empty liquid containing structures for the purpose of inspection and repair.
2. All high-pressure washing and grit blasting equipment.
3. High definition cameras required for inspection.
4. Concrete core drilling equipment.
5. GPR GSS non-destructive testing equipment.
6. Phenolphthalein indicator testing kits.
7. All equipment required for structural repair works.

## As-built drawings, operating manuals and maintenance schedules

### Drawings

Drawings shall be submitted in hard copy and electronically in PDF and CAD (Microstation) format. The approval of Drawings shall not relieve the Contractor of this responsibility to supply the equipment according to the requirements on this Specification. All drawings shall be done in accordance with the Eskom Engineering Drawing Standard – Common Requirements (240-86973501). All drawings and documentation shall be submitted by the Contractor prior to installation work: The following procedure for the approval of Drawings shall be strictly followed

1. Contractor prepares Drawings for approval
2. Contractor checks Drawings for compliance with all requirements of the Specification and submits 3 copies, signed off as checked, to the Engineer for approval
3. Engineer returns 2 copies, stamped as approved or returned for resubmission, to the Contractor
4. Manufacture of equipment commences after approval of Drawings by the Engineer
5. Contractor checks and inspects equipment during all stages
6. Contractor presents Engineer with written confirmation that all equipment is in full compliance with the Specification and has been checked, inspected and fully tested. This confirmation, signed and dated by the Contractor, shall accompany a written request for the Engineer to witness re-inspection and re-testing of the equipment (e.g. distribution board)
7. During the Engineer’s inspections a fault list will be drawn up, if necessary, and handed to the Contractor
8. Only after satisfactory rectification of the fault list and subsequent re-inspection, may the equipment be dispatched to site and
9. The Contractor shall ensure that full copies of the Specification, as well as an approved, signed copy of the Drawings, are at hand during all inspections.

A complete set of Record (“As Built”) Drawings, certified as accurate, shall be submitted to the Engineer immediately after completion of the Installation.

Layout Drawings, issued during tender stage, shall be marked up by the Contractor showing all dimensions to buildings, including the positions of underground cables.

### Instruction Manuals

Three (3) copies of the operating and maintenance manuals shall be provided on delivery of the plant and equipment. These shall come in the form of plastic covered ring files with the following information indelibly printed on their covers.

**MATIMBA POWER STATION**

**OPERATING AND MAINTENANCE INSTRUCTIONS FOR THE**

**NELSONSKOP STW (UPGRADE TO BIOLOGICAL AND HYDRAULIC CAPACITY)**

**SUPPLIED BY:**

(Name, address, telephone, e-mail and fax number of Contractor)

Each page, pamphlet, booklet, diagram, drawing etc. shall be separately bound into the manuals in a clear plastic pocket. Each pocket shall be numbered and indexed.

The first page of each set of manuals shall be an index, which shall include a list of the numbers and descriptions of all drawings and pamphlets included in the set as well as a list of the Engineer’s drawings relating to the relevant sections of the Contract.

The instructions shall include the following:

1. A list of spares, tools and testing equipment supplied under the Contract.
2. A list of spare parts and testing equipment that is not supplied under the Contract but, which may be required for future major overhaul and/or testing of mechanical or electrical plant and equipment.
3. For (a) and (b) above for spares, tools and testing equipment the Suppliers‟ names, addresses, telephone numbers, fax numbers and costs must be listed.
4. List of “Name Plate Data” giving full particulars of serial numbers and other descriptive data pertaining to the plant and equipment installed.
5. List of points requiring lubrication, stating for each point, the type and grade of lubricant recommended and full details as to quantity, timing, and renewing of lubrication. Before typing the manuals, the Contractor shall contact the Engineer to obtain the name and brand of lubricants generally in use by the *Employer*. Wherever possible, suitable grades of lubricant of that particular brand shall be nominated by the Sub-Contractor in the manuals.
6. Particulars of bearings, contacts and other moving parts with instructions relating to any special attention, which may be required.
7. Precautions to be taken in starting, running and stopping the plant or equipment by remote or manual control.
8. Routine tests which the Contractor/Supplier(s) would suggest be carried out.

All information mentioned above shall be cross-referenced to the drawings.

Additionally the manuals shall provide the following electrical information that shall also be cross-referenced to the drawings:

1. Equipment layout drawings
2. Power single line diagrams
3. Control schematic diagrams
4. Narrative description of the control circuit operation
5. Fault finding routines
6. Routine maintenance instructions, procedures, and frequencies
7. Equipment and component specification sheets
8. List of equipment and components including manufacturer, catalogue number and suppliers address, fax and telephone numbers

Further one (1) set of drawings relevant to a particular motor control centre shall be placed in the motor control centre.

# Procurement

## People

### Minimum requirements of people employed on the Site

* All people employed to Provide the *works* shall have South African Citizenship
* All people employed to Provide the *works* shall be trained on health and safety
* All people employed to Provide the *works* shall be trained on doing risk assessment
* All designs provided by the *Contractor* are to be reviewed and signed off by an ECSA registered Engineer in the field of design that is being done.
* CV’s of the key personnel involved in the design, construction and commissioning phases is to be provided with the Tender. Their related experience in wastewater treatment plants or relevant field must be clearly stated with references.

## Subcontracting

### Preferred subcontractors

Not Applicable

## Plant and Materials

### Quality

All equipment supplied by the contractor shall be in accordance to the standards mention in section 6 of this document. It is the responsibility of the Contractor to ascertain the condition of any used equipment or materials, transport to site, corrosion protection, as well as any spares compatibility issues that may present itself in the future.

The Contractor does not use Plant or Materials which are generally recognised as being unsuitable or otherwise to be avoided for the purpose for which they are intended.

Only components of high reliability are utilised, with a proven operating history, to enable the Plant to achieve required reliability and availability. Plant and Material design, engineering and manufacture accord with the best modern practice applicable to high-grade products of the type to be furnished, so as to ensure the efficiency and reliability of the works and the strength and suitability of the various parts for the works.

Plant and Materials withstand ambient conditions and the variations of temperature arising under working conditions without distortion, deterioration or undue strains in any part.

All parts are made accurately, and where practicable, to standard gauges so as to facilitate replacement and repairs. Like parts are interchangeable.

No repair of defective Plant and/or Materials is permitted without the Project Manager’s acceptance and any such repair, if accepted, is carried out in accordance with the Employer’s requirements.

The Contractor ensures that co-ordinated and formally documented management system is in place for the assurance of quality as specified in ISO 9001, Quality management Systems – Requirements.

The Project Manager is free to specify hold and witness points during the installation and on site testing stages of the project. The Contractor issues preliminary notification of such hold and witness points by four days advance notice to the Project Manager, and confirms such hold and witness points at least four days prior to the activity.

Documentation regarding quality procedures is submitted within thirty days of Contract Award. The Project Manager reviews and comments on the acceptability of these documents within the period for reply. If controlled copies of these documents have been submitted to the Employer, then the controlled copy numbers may be quoted in the submission

### Plant & Materials provided “free issue” by the *Employer*

None

### *Contractor*’s procurement of Plant and Materials

* The Contractor supplies and uses suitable and sufficient construction plant, tools and equipment and materials as may be required to carry out the works efficiently.
* The Contractor at all times provides protection for all plant and materials from damage or loss due to weather, fire, theft, unexplained disappearance or similar.
* The Contractor at all times protects from damage, due to the Contractor’s service to provide the Works, all plant and materials and equipment and all items on the site that are the property of the Employer or Others.
* The Contractor provides or manages, as part of works everything necessary for the receiving, inspection, safe keeping and storage, issuing, handling, management and administration of all plant and materials purchased by the Contractor.
* The Contractor provides through the Project Manager and relevant Construction Management personnel the documentation for the warranties from suppliers of all any relevant plant and material used in the execution of the works.
* The Contractor ensures to provide all guarantees and warranties of the plant & materials used in the works to the Project Manager and Employer when construction is completed.
* The Contractor supplies the labelling for the Plant that forms part of the works. The Contractor provides labels for the Plant according to the Matimba label specification. The Contractor makes use of the KKS codes and descriptions provided by the Employer.
* The labels shall be affixed in such a way that they are easily legible and not obstructed by the wiring or by other components.
* Clamping methods applied to the labels shall ensure that removal of the labels requires force. The Project Manager’s acceptance should be sought for the proposed method of clamping prior to use.
* The Contractor supplies to the Project Manager, for verification and acceptance purposes, with a label list showing the text only. The Project Manager’s acceptance should be sought for the positioning and designation of labels.
* The KKS codes are used accordingly on documentation (e.g. drawings, manuals, equipment lists, cable schedules etc.) as a unique identification means. References to plant are accompanied by the relevant KKS code for that item of plant.
* Abbreviations to descriptions on the labels are generally not acceptable. Where abbreviations are unavoidable, due to the limited number of characters that can be engraved/etched on labels, the abbreviations are submitted to the Project Manager for acceptance. The Contractor makes use of the Employer’s “Eskom Plant Labelling Abbreviation Standard; 240-109607332.
* The Contractor arranges all shipments of Plant and Materials and consigns all such shipments to himself as consignee at the project shipping address, freight fully prepaid. The Contractor makes demurrage agreements and settlements with carriers for his shipments.

### Spares and consumables

The Contractor submits, on completion of the design, a detailed listing of the recommended spares and prices for the Project Manager’s acceptance to comply with the aforementioned requirement. The prices quoted shall include for packing, delivery to and off-loading at site, inspection and testing and adequate protection against corrosion, damage and weathering during transit and storage.

## Tests and inspections before delivery

The Employer carries out quality inspections at his discretion without wavering the Employers right to conduct inspections at the Contractor’s site prior to delivery.

All inspections and testing to be performed in accordance with the Quality Control Procedure (QCP) developed by the Contractor.

The Employer will be provided access to the Contractor’s premises for the purpose of:

* Establishing compliance with the contractual requirements by means of inspections, surveillance and audits.
* Witnessing the performance of any tests.

The Employer will inspect equipment forming part of the Plant before they are released from the Contractor’s premises at his discretion. This inspection entails a thorough check to ensure complete compliance with this specification including schedules, design drawings and other applicable standards.

The Contractor obtains clearance from the Employer or the Employer’s agent before despatching of the equipment. This factory release inspection does not release the Contractor of any of his obligations under the contract.

## Marking Plant and Materials outside the Working Areas

All Plant and Material paid for by the Employer must be clearly labelled as being the Employer’s property

## *Contractor*’s Equipment (including temporary works).

The Contractor is liable for all plant & equipment in the designated area under his control. The Employer will not take any responsibility for any loss or damage to the equipment.

# Construction

## Temporary works, Site services & construction constraints

### *Employer*’s Site entry and security control, permits, and Site regulations

The *Contractor* complies with the following:

* Matimba Power Station Health and Safety Standards as per Matimba Power Station Health & Safety

Specifications for Contractors (PA/270/003).

* Compliance with Eskom & Matimba No Smoking Policy
* Adhere to the OHS Act 85 of 1993
* All staff will undergo Safety Induction, presented by Matimba Risk Management Department
* Adhere to Eskom Cardinal Rules at all times
* The *Contractor* must conform to the access control requirements as set out in the document called

“Health and Safety Practices for Contractors at Matimba Power Station”.

* The *Contractor* must conform to the requirements set out in the document called “Eskom Environmental

Practices and Standards”.

* Names and Identity numbers are required seven working days before the contract starts. Photo copies of

Identity documents are also required. This must be arranged with the *Employer’s Representative.*

* Lost permits will be paid for by the *Contractor* to Protective Services at a cost of R300-00 per lost permit.
* Only work vehicles with an approved permit will be allowed on site. No private vehicles will be allowed on

Site.

* Arrangements must be made with the *Employer’s Representative* well in advance to allow sub-

Contractors on *site.*

* The transport of any equipment onto *site* must be declared and documented at Protective Services in

Order to facilitate the future removal thereof.

* Eskom may at its discretion provide any spare parts, materials or equipment as may be required for the

Execution of the contract *works.*

### Restrictions to access on Site, roads, walkways and barricades

The *Contractor* shall adhere to site procedures for roads, walkways and barricades

Access to the site is controlled and it is governed by the terms and conditions lay down by Matimba Power Station security officials. The proposed site will be shown to the Contractor during the site meeting or clarification meeting by the Employer.

The Contractor liaises with the Matimba SHE Practitioner/Officers for Safety Induction prior work to commence.

After induction the Contractor will be issued with a copy of the attendance register for the induction attended. This proof of induction will be used by the Employer to verify attendance prior to signing the Personal Site Access document.

The Contractor’s employees take the signed site access documents to security reception official in order to finalize their site access.

The Contractor ensures that all its employees carry their site access forms with them all the time.

The Contractor is subjected to alcohol testing on a daily basis.

The Contractor submits his application for vehicle permit to the Project Manager. The personnel and vehicles entering and leaving the site are subjected to routine searches.

The Contractor obtains a “Gate Removal Permit” from the Project Manager before materials and equipment can be removed from site. The “Gate Removal permit” gives itemised list of materials and equipment to be removed from site.

The Contractor ensures that a tool list is available on the day of arrival and that all tools are captured on the tool list. The tool list is handed over to the Reception Security official that will stamp the tool list. The tool list is kept safe and used when tools needs to be remove from site.

This message is handed over to any Subcontractor working on Matimba Power Station.

### People restrictions on Site; hours of work, conduct and records

Restrictions and hours of work may apply at Matimba Power Station. The Contractor keeps records of his people on Site, including those of his Subcontractors which the Project Manager or Supervisor have access to at any time. These records may be required in the event of a compensation event for assessment purpose or other cause.

### Health and safety facilities on Site

* The Medical Station is available on site during normal working hours. The after-hours emergency telephone number is 014-763-8311 or from a Matimba phone the extension is 5000 that can be phoned for assistance.
* Fire protection and rescue services are available on site 24 hours per day.

### Environmental controls, fauna & flora, dealing with objects of historical interest

The contractor identifies the environmental aspects and impacts associated with the works and keeps an updated register after approval by the Employer's safety department.

The contractor takes precautions not to disturb any fauna and/or flora (plant or site vegetation) for any purpose, injure or kill any animals, including snakes. The construction site is kept clean and free of litter that can attract pest animal species.

Use of herbicide on site is subject to approval by Employer's safety department. The application must be according to set specifications and under supervision.

The contractor shall submit an EMP indicating plans for managing environmental aspects. The Contractor includes in his method statements and risk assessments, mitigation measures for environmental impacts and aspects.

The Contractor shall comply with the Employer's site SHE specification, the site Environmental Procedure and any other procedures from the Employer and site pertaining to environmental management.

### Title to materials from demolition and excavation

The *Contractor* has no title to any material or equipment delivered under this Contract. He will remove all redundant material and equipment to an area that will be identified by the Contract Supervisor.

### Cooperating with and obtaining acceptance of Others

The Contractor shares a working space with others when required and co-operate with others in obtaining and providing information required in connection with the works.

### Publicity and progress photographs

Cameras and taking or publishing photographs is prohibited.

### *Contractor*’s Equipment

a) The Contractor provides all Equipment that is required to complete the Works.

b) The Contractor’s Equipment does not impair the operation or access to the plant.

c) The Contractor provides all or any temporary or expendable materials required for the storage of material.

Any Equipment, or appliances, used by the Contractor conforms to the applicable OHS Act safety standards and is maintained in a safe and proper working condition. The ProjectManager has the right to stop the Contractor's use of any Equipment which, in the opinion of ProjectManager, does not conform to the foregoing.

### Equipment provided by the *Employer*

Eskom will provide scaffolding where required.

### Site services and facilities

* **Medical Facility and Emergency Services**

Medical Station available on site during normal working hours; the emergency telephone number internal to Matimba is 5000 or 014-763-8311 from an external land line or cell phone and can be used to obtain emergency assistance. The Contractor should provide a COID number (Compensation for Occupational Injury and Disease) and associated documentation when the medical station is visited.

* **Contractor's Yard**

Should the Contractor qualify for a site, the Employer will provide a site within the premises of the Power Station for the Contractor to establish himself for the execution of the works. The Project Manager together with the Site Manager will allocate a site to the Contractor. A site close to the connection points of water, electricity and toilet facilities cannot be guaranteed.

A Contractor qualifies for a site if the answer to at least one of the following questions is affirmative:

* Is the contractor needed on site on a daily basis to carryout his/her contractual duties?
* Does the nature of contract activities demand that the contractor be involved continuously, with his/her contractual duties for the whole day for four (4) or more days in a week?
* In a case of a break down, is the contractor required to respond to the call out within 15 minutes?
* Is there any statutory regulation/s that warrants that the contractor must operate within the premises of Matimba Power Station for the delivery of contractual obligations?
* The *Contractor* is responsible for keeping the site in good state of maintenance and is responsible to ensure that at the end of the Contract period, he informs the Site Manager to inspect the site at least thirty days (30) before the Contract end date. The *Contractor* shall vacate the site allocated to him at the end of the Contract or on termination of the Contract

A written request, indicating the Contractor's requirements in locality and area of storage, office and workshop sites is submitted to the Supervisor as soon as possible after the Contract Date.

* **Roads**

The Employer makes every effort to maintain the roads on the Site in a fair condition and all construction traffic is limited to using these roads. Matimba traffic regulations are adhered to at all times. The speed limit is 40km/h shall be adhered too at all times.

* **Security**

The Contractor is informed of the access procedures through Matimba Procedure PS/270/008, Rev 1, “Access Control and Protection of Eskom Assets” and should expect that such procedures may change depending on the prevailing security situation

Temporary entrance permits are issued to contractors who are on site for less than 3 months. Names and Identity Numbers are required before the contract starts. Photocopies of Identity documents are also required. This must be arranged with the Project Manager. The Contractor will pay Protective Services for lost permits at a cost of R30-00 per lost permit. All permits need to be returned to Security or the Project Manager upon completion of the contract. If it is necessary to bring tools and equipment onto site a list of tools is submitted which is verified by security staff prior to tools entering the security area.

Should any Contractor staff be transferred from Matimba or leave site, the Contractor ensures that personnel leaving site are transported out of the security area and that the permit is returned.

Only work vehicles with an approved permit will be allowed on site. These vehicles are to be in a serviceable condition and road worthy. Temporary vehicle permits are issued to contractors who are on site for less than 3 months. This must be arranged with the Project Manager. Speed limit is 40km/h.

No private vehicles will be allowed on site without a temporary permit.

Arrangements must be made with the Project Manager well in advance to allow sub-contractors and visitors onto site.

To bring cameras and cell phones with cameras on site, permission has to be obtained from the Power Station Manager, using the standard application forms for cameras. This must be arranged with the Project Manager. No firearms, weapons, alcohol, and illegal substances are permitted on site.

No “Private Work” is carried out for or on behalf of any Employer Employee. Any person suspected of being under the influence of alcohol is tested and if proved positive, is refused entry to the security area. Only authorised persons are permitted to enter Red Zone areas.

The transport of any equipment onto the site must be declared and documented at Protective Services in order to facilitate the future removal thereof. Pro-active comprehensive listing of all tools and equipment brought to Matimba will considerably speed up entrance to the power station

No firearms, weapons, alcohol, illegal substances, and cameras are permitted on site. No “Private Work” is carried out for or on behalf of any Eskom Employee. Any person suspected of being under the influence of alcohol is tested and if proved positive, is refused entry to the security area.

Only authorised persons are permitted to enter Red Zone areas.

* **Supply of Electricity**

Electric power for construction, both 220V AC and 380V 3-phase supply, is supplied at Site free of charge, but connection fees are for the Contractor's account. All installations comply with the details set out in Matimba Maintenance Procedure PAM/233/002 - Contractor's Temporary Electrical Equipment Supply, and Construction Power Supplies (Occupational Health and Safety Act - Act 85 of 1993) and the Matimba Safety, Health and Environmental Specification for Contractors, PS/270/003 Rev10.

The Employer does not guarantee continuity of supply and no claims for standing time as a result of power failures will be considered.

A written request, indicating the Contractor's requirements is submitted to the Project Manager as soon as possible after the Contract Date.

* **Water**

Potable and raw water for construction purposes is also available free of charge.

A written request, indicating the Contractor's requirements is submitted to the Project Manager as soon as possible after the Contract Date.

* **Sanitary Facilities**

Permanent toilets to serve the Power Station and urinals at the boundary area have been constructed by the Employer and all the Contractor's personnel may make use of these facilities. The Contractor should as courtesy to Eskom employees and other Contractors on site announce intension to use such facilities with personnel already using the mentioned facility.

Where there is no facility within 100 meters of the site, the Contractor will be responsible for provision of temporary facilities that is serviced at least every two days.

### Facilities provided by the *Contractor*

#### General

The Contractor shall ensure that there are at all times sufficient suitably qualified, experienced, and skilled staff available to carry out and supervise all the activities.

#### Accommodation and transportation

The Contractor provides his own accommodation and transport for all his employees engaged in the execution of the works. This includes the needs of his Subcontractors. The cost for accommodation, as well as for transportation to and from Site is included in the Prices. No accommodation is available at Matimba Power Station.

#### Contractor’s organisation

The Contractor submits a project organogram to the ProjectManager for acceptance, indicating the Contractor’s and the Subcontractors employees.

#### Security

The Contractor is informed of the access procedures through Site Regulations and note that such procedures may change depending on the prevailing security situation.

No firearms, weapons, alcohol, illegal substances and cameras (including cell phones with cameras) are permitted on Site. No ‘Private Work’ is carried out for or on behalf of any Eskom employee. Any person suspected of being under the influence of alcohol is tested and if proved positive, is refused entry to the security area.

#### Subcontracting

All Subcontractors are to be Employer approved Contractor’s / vendors / suppliers. If the Contractor is uncertain of the approval status of the contractors / vendors / suppliers the Contractor formally requests from the Project Manager confirmation of the status.

The Contractor does not procure the services of Contractor’s / vendors / suppliers without the prior approval of the Project Manager. All Subcontractors are to be appointed under NEC with a back to back relationship with this main contract.

#### Refuse Disposal

The Contractor is responsible to keep the work area clean of any rubble.

All waste introduced and/or produced on the Employer’s premises by the Contractor for this contract, is handled in accordance with the minimum requirements for the Handling and Disposal of Hazardous Waste in terms of Government Legislation as proclaimed by the latest National Environmental acts and regulations. The removal of any waste and hazardous waste is the responsibility of the Contractor.

1. Contractor to provide all office and workshop space for the Works under this contract
2. All office and workshop areas to be of acceptable quality and standard

### Existing premises, inspection of adjoining properties and checking work of Others

The Contractor, in conjunction with the Project Manager inspects the site prior to possession. Any defects established during this inspection are listed on the possession certificate. The Contractor is responsible for any defect or damage to plant not listed on the possession certificate which occurred during installation.

### Underground services, other existing services, cable and pipe trenches and covers

The Contractor shall be required to do underground scans prior to any excavation work being done. The results of the scans shall be submitted to the employer in a PDF and CAD format which is compatible with Bently MicroStation. Any damage caused to existing services shall be repaired by the Contractor at his own expense.

### Control of noise, dust, water and waste

**Water**

The *Contractor* shall ensure that no pollution enters surface water or has the potential to pollute groundwater by ensuring that there is containment of spillage (e.g. diesel, oil, etc.) and that there is an emergency plan in place to deal with accidental spillage. Contamination of water sources is strictly prohibited.

**Noise**

Prior to construction, consideration must be given to the noise mitigating measures such as use of suitable and effective silencing devices for pneumatic tools and other plant that would otherwise cause a noise level exceeding 85 decibels. The *C*ontractor submits a plan to the *Project Manager* for acceptance prior to commencement of activities for noise mitigating measures identified.

**Waste**

Waste generation should be avoided, reduced, reused and or recycled. Where this is not feasible, all waste generated during the construction may only be disposed of in terms of Matimba Power station waste management procedure

### Sequences of construction or installation

The Contractor is responsible for the construction and installation of the equipment according to the Contractor’s construction and installation plans.

The Contractor complies with the Employer’s Work Co-ordination Process.

Without derogating from the provisions of the Conditions of Contract, the Work Co-ordination Process is used by the Project Manager to monitor and manage activities on the Power Station and to facilitate the integration and co-ordination of the various works by Others.

If not included in the contract, the Project Manager will notify the Contractor of the requirements of the Work Co-ordination Process prior to the date of site establishment by the Contractor.

### Hook ups to existing works

The adjacent plant and equipment may not be modified without written permission from the Project Manager. The Contractor complies with Eskom Life Saving Rules and will report any non-conformance.

## Completion, testing, commissioning and correction of Defects

### Work to be done by the Completion Date

On or before the Completion Date the *Contractor* shall have done everything required to Provide the Works except for the work listed below which may be done after the Completion Date but in any case before the dates stated. The *Project Manager* cannot certify Completion until all the work except that listed below has been done and is also free of Defects which would have, in his opinion, prevented the *Employer* from using the *works* and Others from doing their work.

|  |  |  |
| --- | --- | --- |
|  | **Item of work** | **To be completed by** |
|  | As built drawings. | Within 30 days after Completion |
|  | Performance testing of the *works* in use. | See performance testing requirements. |
|  |  |  |

### Commissioning

The Contractor shall issue a Completion Certificate in accordance with the NEC clause 35.

The Contractor commissions the works and ensures conformance to the Employer’s performance requirements for the works. The Employer takes over sections of the system as required once the system performance requirements have been verified by the Contractor.

The Contractor submits a commissioning schedule and program for acceptance by the Project Manager. The schedule shall consist of cold commissioning and hot commissioning plan. Prior to the time when commissioning is to commence, the Project Manager will appoint a representative who will co-ordinate the commissioning of all Plant and Equipment forming an integral part of the system being commissioned.

The Contractor, at the time of commissioning, has the agreement, or alternatively, the attendance of the Project Manager involved in a particular phase, before proceeding with commissioning. Consequently, the Contractor must assure himself as to the safety of his own Plant and Equipment in respect of any particular commissioning test and in the event of damage accept responsibility for such Plant and Equipment. In the event of incorrect functioning, the Contractor determines the cause and he corrects the defect.

The Contractor shall provide a commissioning plan highlighting the requirements for commissioning (i.e. potable, demineralised water, air requirements, etc.) and the duration of commissioning. The plan shall also indicate how commissioning wastewater (if any) will be dealt with.

The Price includes all allowances for testing and commissioning whereby all sections of the works are made ready for full duty operation. Testing and commissioning shall include as a minimum:

a) The services of skilled Engineers to supervise the testing and commissioning and making ready for the full duty operation of the complete Works.

b) All management, supervision, labour, tools, instruments, chemicals, test apparatus, calibration equipment and any other equipment and facilities as may be necessary.

The Contractor’s preliminary trials and commissioning of the plants shall be carried out by the Contractor’s representatives, who shall remain in attendance until such time as the plants are working to the Employer’s satisfaction. A requirement of these trials is a 3 x 72 hour performance test to determine that all activities as laid down in the operating manuals are correct and are carried out in the correct sequence and to determine that all the plants have been provided as required in the scope of work.

Where the results of the performance tests performed don’t correlate with expected results (concentration values, flow rates, pressures etc.) and/or the control functions as per the operating philosophy do not meet the specifications guaranteed, the Contractor, at his own expense, carries out all necessary adjustments and modifications to the works required to obtain the stated tolerances. Fully detailed proposals are submitted in writing to the Project Manager for approval before any adjustments and modifications are made and work in this respect is carried out when convenient to the Project Manager.

The operating manuals should be submitted at least 4 weeks prior to the start of commissioning for acceptance by the Employer. Records and reports of all tests and inspections are prepared and submitted to the Employer.

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### Start-up procedures required to put the *works* into operation

The *Contractor* will be required to do plant checks to ensure that the material used and workmanship complies with the specified requirements. The *Engineer* will be attending whilst doing this. The results of those checks shall, if so ordered, be made available to the *Engineer.*

The plant will only be put in operation after relevant safety clearances for all plant and material has been issued by the Contractor and Signed by the Employer.

The contractor will be required to provide the Employer with the relevant start-up procedures.

### Take over procedures

The maintenance and guarantee period will commence on the date of hand-over, which is the date of certification of completion of the works.

Hand-over will not occur until:

1. Testing and commissioning report has been submitted and approved.
2. Operating and maintenance manuals have been submitted and approved.
3. The certificate of compliance (electrical) has been received.
4. All "as-built" drawings (prints and electronic copies on DVD) have been submitted and approved.

As a minimum, the Contractor is required to supply:

1. Two (2) sets of prints of each of the "as built" drawings and two sets of a drawing showing the construction of the major items with parts listed and reference numbers for ordering spares
2. Two (2) sets of prints of each of the diagrams of electrical wiring connections
3. DVD with PDF and CAD versions of above prints compatible with Employers CAD software (Microstation)

Additional requirements may be listed in the technical specifications.

#### Proving Period

After completion of the Contractor’s preliminary trials and commissioning of the plant to the Employer’s satisfaction, the plants will be taken over by the Employer and continue in normal service for a minimum period of 12 months.

During this proving period the Contractor shall optimise all aspects of the operation of the plant and shall be responsible for any defect resulting from faulty design, material and workmanship. The Contractor shall remedy such defects at his own expense and as soon as possible when called upon to do so by the Employer.

Any outage of sections of the plant required by the Contractor during this period shall, as far as practicable, be arranged to suit the convenience of the Employer. The duration of the outage must be supplied to the Employer in advance (at least 1 week) so that necessary arrangements can be made.

Acceptance tests to determine the efficiency, performance and other guarantees specified will be carried out at any time during the twelve months proving period by mutual agreement between the Employer and the Contractor.

#### Acceptance Tests

Acceptance tests shall be carried out to prove all the plant guarantee figures provided by the Contractor in the technical schedules.

For the acceptance tests the Contractor shall include:

* Four copies of the test programme and test sheets
  + - * The services of a skilled testing Engineer that is fully experienced in the type of plant installed to assist the Employer in carrying-out of the acceptance tests throughout their duration.
      * The provision of suitable testing equipment designed to impose simulated varying operating conditions on the plant. The design and use of such testing equipment shall be subject to the approval of the Employer.

When adjustments and modifications are completed, the Contractor advises the Project Manager in writing to this effect and applies for a further acceptance test. From the results obtained, and provided that the Employer is satisfied that it will be lasting, the works will be finally accepted by the Employer.

### Access given by the *Employer* for correction of Defects

The equipment and installation included in this Contract shall be guaranteed and maintained in all respects for the duration of the Defects Notification Period.

The Contractor shall, for the full duration of the Defects Notification Period, be responsible for all work and equipment replacements required, including labour, travelling costs, the replacement of lamps and fuses, etc. Renewals or repairs resulting from misuse however, will not be made at the expense of the Contractor. The Contractor shall repair/replace faulty equipment within 48 hours of notification.

The Contractor shall submit full details of his maintenance and repair service facilities, including statutory holidays, weekends, after hours and normal hours.

The Contractor shall stock the accepted list of spares during the Defects Notification Period. All repairs to be made to the installation due to causes not covered by the guarantees shall be done utilising the above material.

### Performance tests after Completion

On completion of the installation of all plant and equipment the Contractor will required to make appropriate arrangements and supply any instruments or apparatus etc. necessary for the testing of all plant and equipment supplied by the Contractor. Testing shall be in the presence of the Engineer's representative in order to demonstrate compliance with the requirements or the specification.

All tests as detailed in the SANS and Eskom Specifications are to be performed by the Manufacturer for the Contractor and shall be witnessed by the Engineer.

Site testing and Tests on Completion shall be in accordance with the Specifications.

### Training and technology transfer

The Contractor provides training (classroom and hands-on) on the equipment and systems included as part of the works to the various categories of the Employer’s technical staff (operators, maintenance and engineering personnel) for the duration of the works. Training provided by the Contractor is directly applicable to the actual equipment supplied for the works. Generalised training based on similar equipment is not acceptable. The local facilities for training provided by the Employer is a suitably sized air-conditioned room, as well as trainee and trainer desks, an overhead projector and flipchart or white board.

The course material is in English and includes all third party documentation. A copy of the training documentation is supplied for each trainee with an additional 3 master sets for the Employer’s library and training department.

The training dates are included and shown in the Accepted Programme. The supply of drafts, pre-print proofs and printed copies of training documentation is planned by the Contractor in such a way that the required training is complete before commissioning of the Plant.

### Operational maintenance after Completion

The Contractor shall be responsible for the maintenance of all equipment and provision of all lubricants, until the plant and equipment is successfully handed over.

Once the plant and equipment has been successfully commissioned and accepted, the Employer’s site staff will undertake the operation of the plant and equipment and its routine maintenance in accordance with operating instructions and routine maintenance requirements to be furnished by the Contractor prior to acceptance.

# Plant and Materials standards and workmanship

## Survey and Site clearance

The Contractor will be required to do and underground scan of the entire working area to identify the position of existing underground services. Any damage caused to existing services shall be repaired by the Contractor at his own expense. The results of the underground scan shall be submitted to the Employer in a CAD (Microstation) and PDF format. The underground scan should indicate the type (Sewage, water, power etc) and depth of the identified service. The scan should also include coordinates and dimensions of existing benchmarks, to ensure that the exact position of the underground service can be identified prior to any excavation being done.

## Building works

Any additional civil engineering and / or building work, or alterations, to that indicated on the drawings that may be required to accommodate the M & ECI plant in concrete/brickwork structures shall be the responsibility, and to the account, of the Contractor.

Such work shall include but not be limited to excavation, backfilling, the provision of plinths, provision of openings through concrete / brickwork, the concreting / bricking up of openings through concrete / brickwork and the making good of surfaces through which pipes pass.

Infill concrete and grout shall include an approved non-shrink additive.

The Contractor shall also be responsible for:

* 1. The provision of all holding down bolts
  2. Supporting all pipework and plant temporarily until it has been fixed permanently
  3. Ensuring that pipework supplied under this Contract bears firmly against all anchor blocks provided by others.

The cost for such work, as detailed above shall not be measured separately but shall be deemed included in other rates and prices in the Schedule of Quantities.

## Civil engineering and structural works

### New structural design and engineering works

As part of the design package the appointed Contractor shall supply the following: detailed construction drawings, shop/manufacturing drawings, as built drawings and a detail design/calculation report all of which are signed off by a professionally registered engineer. The design of the new structures shall be done in accordance with the latest revision of the standards listed under section *. 6.3.1 Standard Civil and Structural Specifications.*

### Structural inspection and reporting

All the Sewage Treatment Plant concrete structures, which have been identified below require inspection. The areas listed below have been identified through a visual assessment. Should there be additional areas identified when the plant is offline, and a thorough inspection can be conducted, these additional areas will be included in the inspection plan as agreed upon following discussions between the contractor and Eskom.

The concrete structures to be inspected and repaired are as follows:

1. Balancing pond (20.6 x 36.6 x 2 m at bottom with 450 sloping sides plus 0.3 m freeboard)
2. Aeration pond (25 x 16 x 3.6 m with 0.5 m freeboard and 450 sloping sides)
3. Circular clarifier (14 m inside diameter, 3 m depth with peripheral launder and 7.5% floor slope with centre column)
4. Chlorine contact tank (net volume of 33 m3), adjacent to the clarifiers complete with baffle walls. Including a discharge weir box and partitioned section to form a return sludge pump sump
5. Drying beds (x6)

The appointed contractor will be required to do a comprehensive inspection of all the sewage plant and Pump Station 3 concrete and steel structures.

The inspection to be done shall be as follows:

* All water and sludge retaining structures shall be drained and the water/sludge shall be re-routed to the temporary sewage plant.
* All the surfaces of the concrete and steel structures need to be cleaned by means of high pressure water jetting
* All the loose aggregate and fine cement particles should be removed by means of steel brushing if the water jetting is not sufficient;
* Once each individual structure has been cleaned, visual inspections should be conducted on the inside and outside of all the structures;
* The inspections should include checklists and key indicators which will be inspected;
* High definition images should be taken of all the tanks on the inside and outside as well as all the major defects or areas of concern;
* The results of the inspection should be presented in a report format with high quality images of the defects;
* The report shall highlight all the defects found including the extent and location of the defects with proposed methods of repair to restore the structural stability of the structures. The report shall be signed off by a professionally registered structural engineer (PrEng). No candidate engineers or professional technicians/technologists shall be accepted
* The report should also include a cost estimate in the form of a bill of quantities for the estimated cost to do the recommended repair if necessary; the cost should be market related cost. The bill of quantities shall be in accordance the latest edition of the “Model Preambles for Trades” as recommended and published by the Association of South African Quantity Surveyors.
* The submitted report should indicate whether the concrete structures are still safe to use and if there is possibly that leakage or collapse could occur and the time frame related to the modes of failure.
* If there are areas identified where the extent of deterioration seems severe, concrete core drilling should be done to test the strength of the concrete. The concrete drilling should only be carried out if the engineer (contractor) has a concern that the structural integrity of the concrete structures have degraded to a critical point and it has been confirmed with the Eskom representative;
* Concrete core drilling should be done in accordance with the standard method specified in SABS method 865:1994 (first revision);
* If concrete core drilling was done, the capping of the holes as well as the testing should be in accordance with SABS method 865:1994;
* The capping should be done with epoxy/concrete mixture which is water proof and with no leaks;
* The results from the compression test should also be detailed in the results report;
* The report should be submitted in the form of two hardcopies as well as a soft copy in PDF and/or Word document format, the images taken should also be submitted on a memory disc or CD.Non-destructive testing should be carried out on all the concrete structures using GPR GSSI to determine the cover on the rebar, the size of the rebar as well as the concrete strength. The carbonation of the concrete structures should be tested using a solution of phenolphthalein indicator to identify the PH of the cement. Both the results for the NDT and the PH should be presented in the report.

### Structural remedial works

The contractor shall start with remedial concrete and steel work as soon as practically possible to ensure the timely completion of all repairs. The repair works can start in conjunction with the structural inspection if need be.

The Contractor provides the following to the Project Manager for review and acceptance before conducting any works:

1. Comprehensive method statements detailing the following as a minimum, where required:

* Construction methodology and sequence of construction for the repair or removal of various civil and structural components, taking into consideration access restrictions and safety requirements;
* Detailed report with all instances of defects to be repaired based on typical defects that were identified during the inspection conducted by the contractor.
* Materials and machinery/equipment to be used;
* Temporary works to be used including Project Manager’s acceptance of such;
* Manufacturer’s literature/TDS for all materials used e.g. patching materials, anti-corrosion coating, bonding agents etc. including product description, composition, material and performance properties, installation and application procedures, use limitations and recommendations;
* Plan for confining, collecting and disposing of broken concrete and other waste materials as a result of removal operations;
* Works required to safeguard existing infrastructure and services including protection of all surface works and excavations against the ingress of surface water. The Contractor shall take whatever precautions may be required without impacting on plant operations.
* Risk assessments, including taking into account shutdown of plant/ equipment where deemed necessary, in order to execute the works.

1. Quality Control Plans/ Inspection and Test Plans;
2. Rigging studies and design calculations where applicable;
3. Contractor’s Welding Procedure Specifications, Welder Qualification certificates, NDT testing procedure for all new welds which must align to the Standard for Welding Requirements on Eskom Plant (240-106628253);
4. Fall Protection Plans and Working at Heights Plans;
5. Detailed Level 3 Programme encompassing all works, showing float and logical links/ sequence/relationships that connect the various activities together;
6. The Contractor’s temporary works design calculations,

Existing infrastructure and services:

Any damages to existing infrastructure and services resulting from the works are repaired/ made good by the Contractor at his own expense. The Contractor supplies a method statement for the repair works to the Project Manager for review and acceptance prior to conducting the repair works. The Contractor may require removing existing undamaged civil and structural components or equipment/services to facilitate execution of the works stated herein. In such case, the Contractor submits a list of existing undamaged civil and structural components or equipment/services that require removal in a method statement for the Project Manager’s review and acceptance, taking note that permits may be required for such. The cost of removal of undamaged components, preservation/storage and replacement to its original working state is the responsibility of the Contractor. In the case where existing drawings are not available, the Contractor is responsible for compiling drawings signed by a professionally registered engineer with ECSA that are adequate for reassembling of equipment/civil and structural components that require to be reinstated. The Contractor does everything possible to carry out the remedial actions without having the Employer decommission/shutdown any plant/ equipment to facilitate the repairs. Where all options have been exhausted, the Contractor performs a risk assessment to prove to the Project Manager the necessity of the required shutdown. These are formally documented in method statements to the Project Manager for review and acceptance.

Temporary works:

The Contractor designs all temporary works necessary to execute the works. The Contractor’s appointed ECSA professionally registered engineer reviews and approves (by signature) the designs and drawings of all temporary works and additional supports and method statements produced by the Contractor; and supervises, inspects and approves the works as per such. All temporary works designs, where existing infrastructure are impacted by the works, are submitted to the Project Manager for review and acceptance, to prove that the existing infrastructure can withstand the induced load. The Contractor therefore submits all design calculations, in a design report which includes, but is not limited to, all inspection reports, survey data, design analysis models, assumptions, drawings/sketches, rigging studies etc. The Contractor takes full professional accountability and liability for all temporary items required for the execution of the works.

Concrete repair work

The scope includes the supply, testing, delivery and erection complete with grouting, holding down

bolts, joints and sealants where applicable to ensure repairs and/ or member replacement as specified meets its original intent. The Contractor executes all concrete works in accordance with SANS 2001 – CC1 and Standard for Eskom Power Stations Concrete Remedial Work (240-144332407).

#### Substrate preparation prior to remedial action

All concrete substrates need to be prepared in accordance with the following guidelines:

* Areas to be repaired shall be clearly marked.
* All areas to be repaired shall be cleared and cleaned removing all loose material, dust and free water.
* Areas to be repaired shall be saw-cut and/or chipped to a minimum of depth of 10mm in a rectangular shape or until sound concrete is reached.
* Repair edges in water retaining structures shall be dove-tailed.
* A bonding agent shall be applied prior to applying repair products. The bonding agent shall be applied immediately prior to applying the repair product ensuring a wet on wet bond.
* Repair areas shall be protected from wet or windy conditions and direct sunlight.

Reinforcement preparation

All reinforcement to be prepared in accordance with the following guidelines:

* Prior to any remedial action where reinforcement is exposed, remove all tie wires, scour away corrosion mortar/concrete and any other loose material.
* Use a steel wire brush, air pressure, sand blasting or water jetting to clean reinforcement. If the structural integrity of the rebar has been compromised the affected bars should be removed and replaced.
* Prior to concrete repair, the steel reinforcement shall be covered by an approved corrosion inhibitor and bonding agent.

#### Concrete repair

Based on the investigation report done by the Contractor, he shall select the most suitable remedial method for a specific defect. Concrete repair methods that will be required are listed below:

Hand applied mortar

For smaller areas, not requiring formwork, mortar shall be applied by hand. A hand float shall be use to achieve the desired surface finish. Prior to applying the mortar, all deteriorated or defective concrete shall be removed and substrate prepared as follows:

* Carbonated concrete shall be removed to a depth of at least 20mm behind rebar and 50mm into non-carbonated concrete.
* Where concrete deteriorated due to chloride attack, concrete shall be removed to a depth of at least 30mm behind rebar and 100mm into sound concrete.
* Area to be repaired shall be marked clearly.
* Substrate must be damp but without standing/ponding water prior to application of the mortar.

Re-casting of concrete elements

Where concrete deteriorations extend to more than 100mm deep, replacement concrete needs to be used to repair the affected area. Concrete surfaces shall be prepared in accordance with section 6.3.3.1 and new concrete shall be cast onto sound substrate. A hand float shall be use to achieve the desired surface finish. For vertical surfaces formwork shall be installed in accordance with the formwork requirement of this document. The new concrete shall meet at least the minimum material specification for the parent concrete used in the structural element unless an updated design base supersedes the parent concrete specification. Where entire concrete elements have deteriorated, these elements should be recast. Deteriorated concrete elements shall be demolished and rubble cleaned. Elements shall be cast with concrete specifications in accordance with the current design.

Spray concrete or mortar

Spray concrete or mortar shall be used where large repairs are required. Prior to applying spray concrete or mortar, all deteriorated or defective concrete shall be removed and substrate prepared as follows:

* Carbonated concrete shall be removed to a depth of at least 20mm behind rebar and 50mm into non-carbonated concrete.
* Where concrete deteriorated due to chloride attack, concrete shall be removed to a depth of at least 30mm behind rebar and 100mm into sound concrete.
* Area to be repaired shall be marked clearly.
* Sprayed concrete shall not be used in temperatures below 2 degrees Celsius or on substrates exposed to windy conditions or rainfall.
* Substrate must be damp but without free water prior to application of sprayed concrete.

Increase cover by adding additional concrete or mortar

In areas with inadequate cover to reinforcement was provided during either the design phase or construction, the cover shall be increased in accordance with the following requirements:

* If reinforcement is visible remove concrete to at least 25mm behind the reinforcement.
* In cases where the reinforcement has corroded with insignificant effect to structural integrity, the reinforcement shall be cleaned using a steel brush and protected from further corrosion by applying a suitable corrosion inhibitor.
* In cases where the corrosion has affected the structural integrity of the reinforcement, the reinforcement shall be removed and replaced. Lap lengths of newly installed reinforcement shall be in accordance with the applicable SANS standard.
* Formwork shall be installed in accordance with the formwork requirements of this document,
* Concrete or mortar shall be applied to increase the concrete cover to at least 40mm, or as otherwise specified.

#### Concrete crack repair

All cracks with a width greater than 0.2mm need to be properly repaired.

Repair method for cracks where there is no more movement in the structure:

The following repair methodology should be followed for cracks in both vertical and horizontal structure where there is no movement in the structure.

Repair methodology:

* Prepare substrate in accordance with section 6.3.3.1.
* Ensure the area is free from free water.
* Cut a slot with a width of min 20 to 30mm to a depth of 50mm unless otherwise specified by the product TDS.
* Apply repair mortar using a trowel and finish with a render model to desired surface finish.
* Cure repair work for minimum 7 days or as specified in the manufacturers material Technical Data Sheet.

Repair method for Cracks on horizontal surfaces where there is movement in the structure

Repair methodology:

* Prepare substrate in accordance with section 6.3.3.1of this document.
* Widen the crack with a diamond blade about 10mm deep with a V-shape to contain crack injection resin, else build a retaining wall around the crack using neutral builders’ silicone.
* Clean the surface and remove any loose material.
* Fill the crack by capillary action (place resin in reservoir created) using a low viscosity crack injection resin.
* Grind the excess product of and smooth the surface after resin has set.
* Allow to cure as indicated on the product TDS.

Repair method for cracks on vertical surfaces where there is movement in the structure.

Repair methodology:

* Wire brush the length of the crack to remove any lose material.
* In a staggered arrangement on either side of the crack, drill 10mm diameter holes, ranging from 70mm to 150m deep into the crack at an angle between 30 and 45 degrees to the horizontal. Drill the holes at a distance centre to centre 300mm along the crack.
* Clean the drilled holes and crack with compressed air.
* Secure packers in the drilled holes by use of a hammer.
* Inject the resin using a manual or mechanical injection pump. Start injecting at the lowest point. Pump the resin into the packer until it exudes from the next. Then start at the next packer and repeat until it is completely filled.
* Allow to cure for 24 hours or as indicated in the product user manual. Grind down the packers and excess material and restore surface to the desired finish.

#### Concrete surface protection

Surface impregnation is the process of applying products to concrete surfaces which strengthens the surface. The pores and capillaries are filled blocking the concrete pores, thus preventing ingress of harmful substances. Surface coating is the process of improving the concrete surface resistance to external agents. Only approved surface coating and impregnation products may be used and applied in accordance with the repair material section in this document. The selection of coating products shall take into account structures subject to temperature fluctuations, vibration or inadequate joints. The coating material shall accommodate dynamic and thermal movement.

Surface impregnation and coatings shall be executed in accordance with the following methodology:

* Prepare substrate in accordance with section 6.3.3.1 of this document.
* Ensure the area is dry prior to applying surface impregnation products, unless otherwise specified on the product Technical Data Sheet (TDS).
* An approved concrete surface impregnation or coating product shall be used.
* All impregnation products should be based on an epoxy resin; ensure a good bond to smooth surfaces and achieve a penetration depth of >5mm.
* All surface impregnation products should be applied and cured in accordance with product application manual.

Hydrophobic impregnation

Hydrophobic impregnation is the treatment of concrete surfaces to produce a water repelling surface. All concrete structures subject to deterioration through water ingress shall be coated with a hydrophobic impregnation product.

Repair methodology:

* Prepare substrate in accordance with section 6.3.3.1 of this document.
* Clean and dry area prior to application of products;
* All products used shall not fill the surface pores and capillary network, but should line the entire concrete surface;
* All products shall be applied and allowed to cure according to the product Technical Data Sheet.

#### Remedial action for concrete expansion joints

Where concrete expansion joints are deteriorated, the following methodology should be used:

* Remove all dust, liquids and debris from area surrounding joint to be repaired.
* Remove all old material in the joint. Use pressurized water.
* Apply a bonding adhesive into the joints with a brush. Allow the adhesive to dry for a min of 10min or as specified in the product TDS. The adhesive should be sticky to touch and not completely dry.
* Insert a shock absorbing material.
* Apply a layer of self-levelling sealant to seal the joint.
* Barricade the area until sealant has cured as per the requirements of the product TDS.

#### Repair material requirements

All repair material shall meet the following requirements unless otherwise stated:

* Repair material shall be stored, prepared (mixed) and used in strict accordance with the manufactures instruction provided under the material safety and technical data sheets.
* Repair mortars should match or exceed the grade of the structural concrete they have to replace.
* Repair materials should be used as soon as possible after the preparation (mixing) and should never be used after the expiry of their pot life.
* It is not allowed to add water to lengthen the pot life of a mixed repair material.
* Only water which meets the requirements of the repair material manufacturers TDS and acceptance testing applicable in the normative criteria shall be used for construction and repairs.
* Different products used in conjunction (e.g. bonding agent & repair mortar) shall be from the same manufacturer to ensure full chemical compatibility.
* It is recommended that the Contractor have the material manufacturer on site for the first application of the said product to ensure that application is done correctly and that no warrantees/guarantees are voided due to the incorrect application.

#### Formwork requirements

All formwork shall be according to the following requirements unless stated otherwise:

* Formwork shall be selected based on the required surface finish;
* If timber formwork is used, de-molding oil shall be applied to avoid water absorption;
* Foam strips to be used where necessary/practicable to prevent grout loss;
* Suitable openings to facilitate release of trapped air shall be provided where necessary;
* Adequate support shall be provided to prevent formwork from moving during casting.

#### Equipment requirements

All equipment shall be in accordance with the following requirements unless stated otherwise:

* Pneumatic chipping hammers should be hand-held unless noted otherwise, and capable of removing concrete beneath reinforcing bars;
* Sandblasting equipment should be capable of removing corrosion from the reinforcement and contaminants and laitance from newly exposed concrete surface;
* Compressed air equipment should be capable of removing dust and loose material from concrete and steel surfaces;
* Water blasting equipment should be capable of cleaning the reinforcement and roughened concrete;
* All equipment and cleaning material used shall not damage reinforcing steel or the concrete substrate in any way.

#### Concrete curing requirements

All repair works shall be cured for 7 days or as per the manufacture’s repair material recommendations and TDS.

The scope includes for the supply, fabrication, shop detailing, galvanising/ painting as specified, delivery, erection complete with all necessary gusset plates, stiffeners, connections, cleats, brackets, base plates to ensure repairs and/ or member replacement as specified meets the original design intent. The Contractor executes all steel works in accordance with SANS 2001-

#### Corrosion protection of steel elements

The Contractor applies adequate corrosion protection on all identified members in accordance with 240-106365693, Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings. Where there are any discrepancies between the above mentioned standard and this document, this document will get preference.

Equipment

Measuring and Test Equipment:

* The Contractor shall have a blast profile gauge, wet film comb, and a dry film thickness gauge at the shop/site at all times. The Contractor shall also have at the shop/site instrumentation to measure the psychrometric conditions and the substrate temperature.
* The electronic dry film thickness gauge shall conform to the requirements of ISO 2808 and shall be calibrated using the smooth calibration disc supplied by the instrument manufacturer.
* All test equipment and shims shall have current calibration certificates.

Spray Equipment:

* The spray equipment used shall be capable of properly atomising the material and shall be equipped with suitable pressure regulators and gauges. Air caps, needles and nozzles shall be of the type recommended by the coating manufacturer.
* All spray painting equipment shall be fitted with suitable oil and moisture traps.

Power Mixers

* All coatings shall be mixed with power mixers. Low speed mixers which do not induce air into the coating shall be utilised.

Coating materials:

* All materials, i.e. paint, solvents and cleaning agents for a specific paint system shall be supplied by the same manufacturer.
* The solvents used shall be those recommended and manufactured by the coating manufacturer. Where the recommended ‘solvent’ and ‘clean-up thinners’ for a material differ, the ‘clean-up’ solvent must not be added to the coating for dilution purposes.
* Excessive dilution of paints is not permitted. Solvent additions for application purposes shall be in strict accordance with the coating manufacturer’s Product Data Sheet.
* The colours of the paints to be used shall be as specified by the Engineer. All paints and coatings shall be brought to site in new unopened containers. All containers shall be clearly marked with the manufacturer’s material batch numbers and other relevant information.
* The Contractor shall ensure that the colour selection of the coat immediately prior to the finishing coat shall be suitable for complete obliteration by the finishing coat.

Surface preparation

General:

* Sharp edges shall be dressed to a radius of not less than 2 mm, but no more than half of the section thickness. All burrs, rags and weld spatter shall be removed as per the requirements of ISO 12944-3.
* Welds shall be free from imperfections (e.g. asperities, undercutting, blowholes, craters, and spatter) which are difficult to cover effectively with a protective paint system. The onus is on the Contractor to ensure that the surfaces are ready for coating.

Pre-cleaning:

* Oil and grease shall be removed by high pressure water washing with detergent solution and rinsing with clean water prior to wire brushing and application of coatings.
* Chemical and cleaning contamination shall be removed by means of neutralising or flushing or both. It is important that clean potable water is used for cleaning, or the surfaces will be left contaminated after washing. The surfaces shall thereafter be allowed to dry completely prior to coating or before continuing with the rest of the surface preparation process.

Wire brush cleaning and grit blasting

* Wire brush cleaning and grit blasting shall be used to remove all signs of corrosion and loose paint.

The following requirements shall apply prior to coating application:

* All surfaces shall be free from dust and debris.
* If the wire brushed/grit blasted surface changes colour, or rust bloom begins to form, the surface shall be re-brushed.

Coating application

Approval:

* No work shall be performed until the Quality Control Plan is approved by Eskom.

Mixing:

* The Contractor shall ensure that all paints are mixed in accordance with the manufacturer’s instructions.
* In the case of two pack materials, the splitting of kits as supplied from the factory is not permitted.

Coating:

* The primer coat shall be applied as soon as possible after the surface preparation operation during the same shift as the blast cleaning operation, but under no circumstances may the primer be applied over rust bloom or over surfaces that have changed colour due to humidity or other contamination.
* Coating application and cleaning shall not take place when site conditions are likely to negatively affect these operations. The Contractor shall ensure that the necessary protective equipment is used to prevent contamination of the coatings and to minimise delays due to such site conditions.
* Successive coats shall be of distinctly different colour to the previous coat to ensure correct intercoat coverage. However, two finishing coats of the same colour may be applied to achieve complete colour uniformity. Special attention shall be given to cracks, crevices and edges to ensure complete coverage and paint thickness. All finishing colours shall be to the Eskom Engineer’s approval.
* Concealed surfaces shall be completely coated. Suitable sponges may be used for application of coating to concealed surfaces or back to back angles. In the case where it is impractical to coat the concealed surface, the opening shall be sealed utilising an approved mastic material.
* All edges, corners, bolt holes, mouse holes, cut ends and weld beads shall be stripe coated by brush application, prior to the application of the intermediate coat. The stripe coating shall be an additional coat of the specified intermediate coat. In order to assist in its identification, the stripe coat shall be a different colour to both the specified intermediate coat and finishing coat. Under no circumstances shall stripe coating be carried out by roller or spray-application.

Application:

* Unless otherwise specified, all coatings shall be applied by airless spray techniques.
* In instances where spray application is considered not to be possible, practical or feasible, this must be brought to the attention of the Eskom Engineer at the time of tendering.
* Unless otherwise specified, all application work shall be carried out in strict accordance with the recommendations and instructions given in the signed Product Data Sheet supplied by the coating manufacturer.
* All coatings shall be evenly applied to form a smooth, continuous, unbroken coating free from tears, runs, sags, wrinkles, blisters, mud-cracking, change in colour or gloss, orange peel, visible pin-holes, dirt, dust or fluff occlusions or any other visible defects. Each coat shall provide complete coverage.

Fasteners

* All nuts and bolts shall be hot dip galvanized. All fasteners used shall be grade 8.8.

Inspection and testing

Visual inspection:

* Visual inspection for paint film defects shall be performed after each coat is applied. All defects including pinholes, runs, sags, dry spray etc. shall be corrected based on the requirements of ISO 12944 Part 4, before the next full coat is applied. Inspection and rectification shall be based on the requirements of ISO 12944 Part 4.

Dry Film Thickness (DFT):

* DFT shall be measured in accordance SABS ISO 2808 and instruments shall be calibrated using the smooth calibration disc supplied by the instrument manufacturer.
* The frequency of dry film thickness readings shall be a minimum of three reading per square metre of coated surface.
* The product data sheet shall indicate the required minimum and maximum DFT. The DFT is given in a range for each coat in the relevant coating system. These are the required minimum and acceptable maximum thicknesses. No individual thickness shall be less than 80% of the specified minimum thickness and not more than 20% of thickness measurements taken shall be less than the specified thickness. No individual thickness shall be greater than 120% of the specified maximum thickness.
* The increase in thickness created by the application of the stripe coat shall not be used to justify recorded thicknesses that are in excess of the maximum specified thickness of the system.
* All deficient film thicknesses shall be rectified to the approval of the Eskom Engineer at the Contractor’s expense.
* Actual readings and not averages shall be recorded.

Guarantees

* Eskom requires a guarantee of 15 years on all coating systems. Such guarantees shall be provided jointly by the Contractor in collaboration with the coating applicator/s and manufacturer’s at the time of tender.
* Although visible coating defects such as blistering, cracking, flaking and peeling are not always associated with visible rusting, they indicate defects that could either lead to substrate corrosion or are shielding substrate corrosion that has already taken place beneath the coating. Any such defects noted during the guarantee period shall be the Contractor’s responsibility and shall be repaired.

Specification for protective coatings (mild steel in aggressive external environment < 80 0C)

* Surface preparation shall be done in accordance with this document.
* Primer shall consist of a two component epoxy zinc prime (min 80% zinc in the dry film).
* Intermediate coat shall consist of a two component recoatable epoxy micaceous iron oxide
* Top coat shall consist of a two component polysiloxane finishing coat.

The following surfaces shall be coated in accordance with the above specification:

* Aeration tank steel structure.
* Sludge Pump Sump steel hoist frame.
* Pump Station 3 crawl beam

Specification for protective coatings (Hand railing/Stanchions)

* Surface preparation shall be by means of sweep blasting or a suitable galvanized iron cleaner as recommended by the coating manufacturer.
* Primer shall consist of a galvanising tie-coat/ primer.
* Top coat shall consist of a two component polyurethane acrylic finishing coat.

\*All hand-railing on the STP shall be repainted in accordance with the above specification.

#### Sludge pump sump step iron replacement.

The Contractor shall be responsible to remove and replace the step irons in accordance with Eskom drawing 0.58/11611. The new step irons shall consist of 20mm diameter galvanised round bar.

#### Replacement of IBR roof sheeting

Roof sheeting to consist of IBR 890, 0.5mm Standard Chromadek sheeting (Z200 hot-dipped galvanized substrate pre-primed with a primer (Dry film thickness (DFT) of 5µm) and finished with a final paint coat (DFT of 18 -22µm) on the top surface. A single backing coat (DFT of 8µm) is normally applied to the reverse side of the sheet).The Contractor shall supply a material certificate from the supplier with the delivery of the Chromadek sheeting. The colour of the roof sheeting shall be determined after contract placement

### Laboratory refurbishment

Removal of existing infrastructure:

The following infrastructure needs to be removed by the *Contractor* and be disposed of into a skip provided by the *Employer*:

* Taking up and removal of exiting vinyl floor tiles (18m2).
* Hacking up and removing porcelain wall tiles (116m2).
* Built-in air-conditioning unit (1).
* Existing cabinets, frame and sink in laboratory.
* Vitreous china Washing Closet (WC) pan with cistern, including short lengths of piping (2).
* Vitreous china toilet roll holder; single roll holder (2).
* Stainless steel Wash Hand Basin including short lengths of piping (2).
* Remove and put aside hand-soap dispenser to be reinstalled at a later stage (2).
* Towel rails (2).
* Shower Heads and taps (2).
* Shower curtains (2).
* Mirrors (2).

Making good of doors:

External doors (2). The two external wooden doors shall be removed from their hinges and completely striped from any previous paint or varnish by sanding. The doors will then be coated by a suitable wood preservative that will provide protection and waterproofing in an external environment. The selected product shall provide protection against fungal attack and should not peel, crack or chip even after prolonged exposure. Each door shall be coated with three coats in accordance with the manufacturer’s recommendation. Once the doors have been coated they shall be placed back into their original position.

Internal doors (6). The six internal wooden doors shall be removed from their hinges and completely striped from any previous paint or varnish by sanding. The doors will then be coated with a high quality solvent based enamel which is suitable for wooden doors and has a high gloss finish. The selected paint shall have a 7-year quality guarantee. Each door shall be coated with two coats in accordance with the manufacturer’s recommendation. Once the doors have been coated, they shall be placed back into their original position. The *Contractor* shall supply the *Client* with three color samples. Each sample shall be painted onto the door.

Building up of old air-conditioning unit opening:

All walls shall be built in accordance with SANS 10400-K: 2015 (Walls) and SANS 2001-CM1: 2012 (Masonry walling). New bricks to match existing and will be placed in class II mortar. The opening will be plastered on the inside only (4m2). Type 1 joints will be used to connect new walls to existing.

New floor tiles

The new kitchen/lab and bathroom floor tiles shall consist of 350 x 350mm ceramic floor tiles or similarly approved. The *Contractor* shall submit three different samples of each of the tiles for the kitchen/lab and bathroom for selection.

New wall tiles

The new kitchen/lab and bathroom floor tiles shall consist of 600 x 300mm ceramic floor tiles or similarly approved. The *Contractor* shall submit three different samples of each of the tiles for the kitchen/lab and bathroom for selection.

New mosaic shower tiles

The new mosaic shower tiles shall consist of porcelain tiles in a herringbone pattern. The tiles shall be provided in sheets. The *Contractor* shall submit three different samples of the mosaic tiles to be used in the showers.

Wall and floor tiles to be fixed with a suitable cement-based polymer modified tile adhesive designed for the installing of ceramic and porcelain tiles onto all types of cement based surfaces as well as other pre-primed surfaces. Once set, a cement based polymer modified grouting compound designed to point tile joints up is to be used to grout all the wall and floor tiles. The selected grout should improve flexural strength, increase abrasion resistance, minimise shrinkage, reduce dirt pick-up and increase water resistance. The selected grout color should match that of the tiles.

For the installation of the mosaic tiles a cement based polymer modified adhesive that is suitable for wet areas as well as in underwater conditions is recommended. The selected product must protect against the growth of mildew and algae.

New laboratory cabinets

The new cabinets that are to be supplied must be similar to the existing cabinets with regards to the cupboard, drawer and shelving layout. The cabinets must be fit for purpose and must be manufactured to resist laboratory chemicals. Frames to be manufactured from epoxy coated steel and must be fitted with adjustable feet to accommodate for uneven floor surfaces. The color of the frame will be determined on site. The working surfaces of the cabinets shall consist of laboratory grade phenolic resin. The working surface must be chemical, wear and water-resistant and must be 900mm high. Cabinets shall consist of melamine with high impact resistant PVC edging on all doors and drawers. Hinges and drawer runners shall be of a high quality. Under bench units shall be 500mm deep and designed for a 900mm high work surface. Wall cupboards to be 300mm deep and 600mm high. Cabinet door and drawer handles to consist of full width aluminum extrusions that is covered with an epoxy coating. The handles must be wear resistant and easy to clean. The table below gives a summary of the new cabinets that need to installed:

|  |  |
| --- | --- |
| **Cabinet description:** | **Quantity** |
| 1000mm Double door cabinet with two drawers. | 7 |
| 500mm Four drawer unit. | 2 |
| 500mm Waste bin unit. | 2 |
| 1000mm Double door cabinet with blank for sink. | 1 |
| 1000mm Sliding glass door cabinet (wall mounted). | 5 |

New laboratory sink and tap

The new sink must be purposely fit for the above mention 1000mm double door cabinet that has a blank space for a sink. The sink must consist of a polypropylene injection molded sink that has a high chemical resistance. Dimensions: 552 x 400 x 231mm. The new tap must be polyester powder coated to ensure resistance against chemicals, UV fading and heat. The tap should comply with the following specifications:

* Handles: Metal polyester coated hot and cold handle with 180o opening function.
* Full swivel action spout.
* Ceramic headwork.
* 0-90oC Temperature range.
* Maximum working pressure of 10bar.
* Fixed metal nozzle.

New fridge

The *Contractor* shall supply and deliver a double door fridge for the storage of samples. The fridge will have the following specifications:

* Dimensions Height: 2020mm Width: 1140mm Depth: 635mm
* Clear glass doors.
* Gross capacity: 918 liters.
* Electronic temperature controller.
* Refrigerant type: R134a
* Number of shelves: 8 (minimum).
* Temperature range: 4 degrees Celsius.
* Voltage: 220-240.

Installation of new sanitary fittings:

The *Contractor* to supply and install two (2) Coral white front flush WC suites (or similar approved) comprising of WC pan, double flap heavy duty plastic seat and cistern. The WC suite to be SABS approved.

The *Contractor* to supply and install two (2) 570 x 465mm Coral Avocado Wall Mounted Basin & Floor Pedestal Sets or similar approved.

The *Contractor* to supply and install two (2) Cobra – Metsi MI-294 basin mixer with cast fixed outlet or similar approved. The mixer shall include chain, stay, mounting kit, and 2 × 1/2" female iron 400mm long flexible inletsThe *Contractor* to supply and install two (2) chrome Cobra Stella shower sets or similar approved which includes two under wall stop taps, flanged shower arm and shower rose. The shower set to be SABS approved, SANS 226 Type 2. The *Contractor* will be required to increase the height of the existing shower heads.

The *Contractor* to supply and install two (2) Portofino Cara Chrome, or similar approved Robe Hooks. The hooks to be manufactured from high quality brass with a chrome-plated finish and carry a 5-year manufacturing guarantee.

The *Contractor* to supply and install two (2) Portofino Cara Chrome, or similar approved shower soap holders. The soap holders to be manufactured from high quality brass with a chrome-plated finish and carry a 5-year manufacturing guarantee.

The *Contractor* to supply and install two (2) stainless steel lockable toilet roll holders. Each toilet roll holder shall be capable of holding three (3) toilet rolls.

The *Contractor* to supply and install two (2) shower curtains. The curtains must be 100% Polyester water resistant finish with drip dry technology. Curtain to include 8 hooks. Dimensions: to fit shower opening. Color: White. Warranty: 12 Months.

The *Contractor* to supply and install two (2) stainless steel restroom signs (150 x 150mm). One male and one female. The *Contractor* shall explain his preferred method of fixing the signs to the door in *his/her* method statement. Double-sided-tape or any other form of glue shall not be acceptable.

Plumbing and drainage

The *Contractor* shall remove and replace the existing drainage pipe going from the laboratory to the sludge sump (40m). The new drain shall consist of a solid wall Class 34 (Heavy duty) 110mm OD uPVC pipe that is laid with suitable flexible joints to allow for movement. Pipes shall comply with the requirements of SANS 791:2014. The pipe should not deteriorate in contact with water or sewage. The pipe trench shall be excavated to a minimum width of 700mm and to a depth that is equal to the base of the existing pipeline. Any hard rocks or boulders shall be removed from the trench. The pipe trench shall be backfilled with excavated material and compacted to 90% MOD AASHTO. Only solvent cements, lubricants and solvent cleaners recommended by the pipe or fitting manufacturer should be used in the jointing of pipes and pipe fittings.

Glazing

The *Contractor* to supply and install two (2) 600 x 900mm framed glass mirrors. The frame selection shall be subject to the *Client’s* approval.

Paintwork

Previously painted plastered surfaces shall be washed down and allowed to dry before paint is applied. Blistered or pealing paint shall be completely removed and cracks shall be opened, filled with a suitable filler and smoothed. Walls shall be coated with one coat of low odour premium quality velvet sheen paint coating that is highly washable and stain resistant. The paint shall be applied to a suitable thickness that will ensure that the underlying paint layer is not visible. The selected paint shall carry a 15-year Manufacture Quality Guarantee. The *Contractor* shall provide three painted colour samples.

Ceilings shall be coated with one coat of low odour premium quality velvet sheen paint coating that is highly washable and stain resistant. The paint shall be applied to a suitable thickness that will ensure that the underlying paint layer is not visible. The selected paint shall carry a 15-year Manufacture Quality Guarantee. The *Contractor* shall provide three painted colour samples.

### Guarantee on all structural repair work and coating systems

The Contractor shall provide a 10 year guarantee on all structural repair work and coating systems that were installed.

### Drying Bed Sand Replacement

The sand and gravel in the drying beds (x6) shall be removed, disposed of in an approved disposal facility, and replaced with new sand.

The drying beds will be thoroughly cleaned, the bottom distribution system and laterals will be inspected, and a proposal shall be provided to Employer for any repairs needed.

The sand and gravel change will be as follows:

1. Graded gravel to be placed around the bottom drains in layers up to 30cm with a minimum of 15cm above the top of the bottom drains. At least 60 cm of top layer should consist of gravel of 7 to 15 mm size.
2. Clean sand of effective size of 0.5 to 0.75mm of uniform coefficient not greater than 4 to be used. The depth of sand may vary from 50 to 60cm.
3. Coarse gravel should be put back after the inspection of the drying beds and then graded gravel layer will follow.

### Additional Sewage Handling and Treatment

The existing works is a single line installation and as such, it is necessary that process flow be maintained during the execution of the works.

It is possible to stop the forward flow on the plant for limited time (approximately 5 hours) at low-income flow periods however, the sewage handling plant will not be shut down and the incoming sewage will have to be treated while the inspections, testing and refurbishment is taking place.

A proposal on treating the influent to sewage plant, during execution the works, will form part of the tender package. The current layout of the sewage plant is shown in drawing – “20.58/14933 Sewage Treatment works Eskom Matimba” Power Station. The operation and control of the sewage treatment plant will remain under supervision of tenderer during the construction.

The proposal needs to have a cost breakdown and needs to cover all costs expected by the contractor.

Tenderers shall allow for bypassing, diverting or maintaining forward flow during the execution of the whole works.

The alternative treatment plant shall meet the following requirements:

* Fit in the existing premises of the plant
* Effluent quality shall comply with general limits
* Plant shall be commissioned in no more than 12 months
* Shall be a proven technology that has been in operation for over 5 years. Technology that is in a research phase or piloting stage will not be accepted.

It is the sole responsibility of the contractor to select the treatment system. The contractor can choose to construct a new plant/module, retrofit the existing plant or supply a mobile/containerised system. A very detailed proposal shall be submitted with the tender.

In the event where the Contract decide to retrofit the system, it shall clearly state how the new streams will be interphase with the existing system. The contractor shall evaluate the capability of the existing infrastructure from the raw sewage screening to the settling tank (clarifier).

The selected alternative stream shall be able to treat raw sewage of the quality stated in section.. of this works information.

### Standard Civil and Structural Specifications

The latest edition as at date of tender of the following specifications shall apply:

|  |  |
| --- | --- |
| **Number** | **Description** |
| 240-106365693 | Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings |
| 240-56364545 | Structural Design and Engineering Standard |
| 240-56364535 | Architectural Design and Green Building Compliance Manual |
| 240-57127953 | Execution of Site Preparation and Earthworks Standard |
| 240-106628253, | Standard for Welding Requirements on Eskom Plant |
| 240-144332407 | Guideline for Eskom Power Stations Concrete Remedial Work |
| SANS 1200 | Standardized specification for civil engineering construction |
| SANS 10160 (1-8) | Basis of structural design and actions for buildings and industrial structures |
| SANS 10162 (1, 2 & 4) | The structural use of steel |
| SANS 10100 (1-2) | The structural use of concrete |
| SANS 2011 (All) | Construction works |
| SANS 2001 – CC1 | Construction works Part CC1: Concrete works (structural) |
| SABS Method 865 | Concrete tests - The drilling, preparation, and testing for compressive strength of cores taken from hardened concrete |

Copies of the above listed SANS specifications are not bound into this document. They can be purchased from the SA Bureau of Standards directly.

For all Building Works, the latest edition of the “Model Preambles for Trades” as recommended and published by the Association of South African Quantity Surveyors shall apply. This Standard Specification in not bound into this document but may be purchased from the Master Builders Association directly.

In the event that there is a discrepancy between the SANS 1200 Specifications and the “Model Preambles for Trades”, the SANS 1200 Specifications shall take precedence.

## Electrical & mechanical engineering works

### Scope

This Specification covers the design, supply, delivery, installation, testing, commissioning, decommissioning and guarantee of the electrical, control and instrumentation installation as per the relevant Drawings and Specifications.

The Scope of work includes:

1. MCC should be designed in such that the overall dimensions the existing space or room. The newly designed MCC must fit on the existing cable trench.
2. Low voltage and instrumentation cabling
3. Control instrumentation
4. Detail design drawings, including motor schematic diagrams and instrument and control termination diagrams
5. Earthing and lightning protection
6. Any other installation materials stated or implied to provide for a complete installation in accordance with the Specifications, Drawings and Schedules supplied
7. Provide certificate of compliance

### General Information

1. Only equipment based on proven technology and of high reliability shall be considered for use.
2. All schedules included in the Tender Document shall be completed in full and submitted with the Tender.
3. All relevant technical information regarding each component or item offered shall be included either in the forms to be completed by the Tenderer or as an Appendix to the Tender, in order that the Engineer can make a proper evaluation of the offer.
4. Preference shall be given to locally manufactured equipment and components. Should items not be locally manufactured, Tenderers shall clearly identify these in their Tender. Where Tenderers choose to offer imports in lieu of locally manufactured items, these shall be offered as an alternative offer, with the local items included in the main offer.
5. Where products of a particular supplier are specified, the supply of equal products from other suppliers may also be supplied if approval for such products is obtained from the Engineer.

### Standards and Regulations

All materials and equipment shall be new and of the standard and quality specified.

Tenderers shall ensure that they are fully acquainted with the contents of the applicable Electrical Specifications.

The wiring installation shall comply fully with SANS 10142 as amended.

The design and manufacture of equipment and the complete installation shall be carried out and tested in accordance with the latest issue or amendments of the following Regulations, as applicable:

1. SANS 10142-1 – The wiring of premises. Part 1: Low-voltage installations.;
2. The Occupational, Health and Safety Act, (Act 85 of 1993);
3. The local Municipal by-laws and Regulations and Regulations of the local supply authority;
4. The Fire Brigade Services Act, 2000 (Act 14 of 2000);
5. The Regulations of Telkom (S.A) Ltd;
6. The National Building Regulations and Building Standards Act, (Act 29 of 1996); and

### Standard Mechanical Specifications

All the materials used in the Works shall be the best of their respective kinds and shall comply in all respects, in so far as this may be applicable, with the requirements of the latest South African Standard Specification, or British, American, or European Standard Specification where specified.

The following Standard Specifications apply to this Contract unless indicated otherwise:

|  |  |
| --- | --- |
| **Number** | **Description** |
| SANS 62 | Steel pipes and pipe fittings up to 150 mm nominal bore suitable for screwing to SABS 1109 pipe threads |
| SABS 136 | ISO metric precision hexagon head bolts (coarse thread medium fit series), screws and hexagon nuts |
| SANS 460 | Copper tubes for domestic plumbing services |
| SANS 664 | Cast iron gate valves for water works |
| SANS 719 | Electric welded low carbon steel pipes for aqueous fluids (ordinary duties) |
| SANS 763 | Hot dip galvanised zinc coatings (other than on continuously zinc-coated sheet and wire) |
| SANS 965 | Stainless Steel Pipes |
| SANS 1123 | Steel pipe flanges |
| SANS 044 | Welding |
| SANS 064 | Preparation of steel surfaces for coating |
| SANS 0111 | Engineering drawing |
| SANS 141 | Dry film thickness of paints by means of magnetic flux type gauge |
| BS 1452 | Specification for grey iron casting |
| BS 2035 | Cast iron flanged pipes and flanged fittings |
| BS 2633 | Class 1 welding of ferritin steel pipework |
| BS3605 | Seamless and welded Austenitic stainless steel pipes and tubes for pressure purposes |
| BS 4999 | General requirements for rotating electrical machines |
| BS 5080 | Methods of testing for structural fixings in concrete and masonry |
| BS 5316 | Acceptance tests for centrifugal, mixed flow and axial pumps. |
| API STD 1104 | Standard for welding pipelines and related facilities |

Reference to the above specifications shall be deemed to be referenced to the latest issue of the relevant specification at the time of tender.

### Material

All switch boards, distribution boards, and control panels shall be manufactured as per Eskom latest approved standard.

All steelwork, cable trays, and cable ladders shall be hot-dipped galvanised.

All fixing bolts, nuts, washers, brackets, etc., shall be stainless steel.

### Power Supply

Power supply (380V) will be from the existing mini-sub on site.

### Manuals

Before the Tests on Completion date, the Contractor shall submit a set of complete technical manuals to maintained, service and repair the installation. These manuals shall contain, as a minimum requirement, the following information:

#### Electrical Equipment

Drawings and manuals as specified in the Standard Specifications for the applicable equipment shall be provided. Documentation shall also include all the factory and site test certificates and final test set points.

#### Installation

The Engineer shall provide the Contractor with one set of layout drawings, similar to those enclosed with the Tender Documents, to mark up all the “As Installed” cable routes and equipment.

Included in this portion of documentation shall also be all cable test certificates of tests performed both by the manufacturer and after installation. All site test certificates including earth resistance measurements, loop testing, functional testing, etc., shall be included.

Sets of the complete cable schedules shall be provided, showing the “as installed” status, sizes, quantities, cable and core numbering, core types and cable types of all cables installed, excluding cabling for single- and three-phase socket outlets. This shall include cabling installed for signals, pilots and for metering.

## Motor Control Centres (MCC)

### General

The existing main MCC shall be replaced with a new MCC as shown on the drawings and as specified. This MCC and the motor starter panels for Transfer Pumps shall be disconnected and removed by the contractor.

The existing MCC is 1820mm long. MCC room dimensions are 3200 x 2040mm. The contractor shall indicate at tender stage that his MCC will fit into the existing room. Variable speed drives and PLC cubicle can be mounted separately where applicable. The contractor must do their own measurements of the existing MCC and room.

Existing cables as shown on the single line diagram shall be tested before connecting-connecting to the new MCC. Existing cables shall be replaced with new cables where indicated on the single line diagram. Cables are bottom entry.

The MCC shall be vermin-proof type, manufactured from sheet steel having a minimum thickness of 2.0 mm.

Starters, incoming breakers, and local DB (Distribution Box) shall be housed in separate compartments. Each separate compartment shall be provided with a hinged door, which shall be arranged so that it cannot be opened while the apparatus contained therein is alive, unless this apparatus is fully shrouded or screened to prevent inadvertent contact. Where the apparatus contained in the compartment is provided with an isolating switch or MCB, the door shall be mechanically interlocked so that it cannot be opened unless the switch is in the "OFF" position.

An Uninterrupted Power Supply (UPS) for instrumentation and PLC power shall be mounted inside the MCC in its own compartment.

The MCC shall be floor standing, front access, and bottom entry with the gland plates at least 600 mm from ground level.

The busbars shall be positioned in such a way to allow for easy extension to the sides by adding additional panels, and to allow for cable entry from the bottom and top. Their spacing shall be in such a way that the cables could be connected to them in a neat and safe configuration.

The busbars shall be rated for the full load capacity of the main switch and shall be capable of withstanding the fault level as indicated on the Drawings for 3 seconds.

All equipment shall be rated for a 15 kA fault level as indicated.

Indicating lights shall be of the LED cluster type. They shall be provided with a lamp test push button to verify operation.

Surge arrestors shall be complete with failure indication. Surge arrestors shall be solidly earthed by means of 16 mm² insulated earth wires.

### Busbars

Horizontal power busbars and vertical busbar droppers shall be copper, of constant cross sectional area throughout their length, and shall be mechanically braced for the short circuit current value as specified. All busbars shall be of suitable rating and not more than 1.8 A/mm2.

Contact surfaces of busbars at splices and bolted joints shall be silver plated or chemically cleaned by a process approved by the Engineer.

Busbars shall be colour coded.

Holes in busbars shall be jig-drilled or punched so that they are perfectly round and only with sufficient clearance to suit the correctly size of bolt. All busbar ends behind the blanking off covers shall be pre-drilled for fishplates.

The main horizontal busbars shall be completely isolated from the other zones. The vertical power busbar droppers on each panel shall be insulated or isolated so that with the compartment door open or the main cableway door open, access cannot be gained to live busbars.

Horizontal and vertical busbars are to be fixed on non-tracking insulators, at suitable intervals to withstand the dynamic forces under the full short circuit conditions. Bolted joints in busbars are to be joined using copper fishplates of equal section to the busbars and using high tensile bolts and lock-washers.

### Wiring

All wiring must be done according to SANS 10142-1 as per amendments.

### Earthing and Bonding

A continuous copper main earth bar shall be run for the full length of the Motor Control Centre with a minimum cross sectional area of 70 mm2.

All equipment requiring earthing shall be effectively earthed to this main earth busbar.

The Contractor shall ensure that all cable gland plates are effectively earthed via the steelwork of the panel or provided with individual bonded conductors.

### Motor Control

An auto/manual selector switch shall be provided for each starter. The motors shall be controlled by PLC in auto mode and controlled locally with stop and start pushbuttons in manual mode. All the trip conditions must still be in place during manual operation.

Duty and standby pumps (1 x duty and 1 x standby) shall be alternated with each start (flip-flop). The standby pump shall start in case of failure of the duty pump. An alarm indicating that a pump set is inoperable and that the pump set has been substituted by the standby pump set is to be activated when a duty pump fails.

Motor control shall be as indicated on the Piping and Instrumentation diagrams and control philosophy. Audible and visual (flashing light) indication shall be provided for alarms and faults. The audible alarm shall be resettable by means of a reset pushbutton. The visual alarm (flashing light) shall remain activated until the fault has been cleared.

### Inspection and Testing

The Engineer may carry out periodic inspections during various stages of manufacture.

Final factory tests of the MCC shall be carried out before despatch from the works.

These tests shall include, but not be limited to, the following:

1. Tests to determine that the apparatus fully and strictly complies with the requirements of the Specifications;
2. Comprehensive primary injection tests of all current transformers and associated circuitry;
3. Comprehensive pressure tests to prove insulation quality; and
4. Functional tests of all control gear and the feeders.

The Manufacturer shall make provision for all power supplies, testing equipment, simulating apparatus, and competent personnel to carry out the tests.

At least two weeks’ notice of the manufacturer's intention to carry out final tests shall be given to the Engineer. All test results shall be recorded on standard test sheets and three copies shall be provided to the Engineer within one week of satisfactory tests being completed.

Once equipment has been erected on site, the following tests and field checkouts shall be performed:

1. Random primary and injection tests to check that the functioning of control current transformers and associated circuitry has not been disturbed
2. Random checks on the functioning of control gear and
3. Comprehensive insulation resistance tests to prove that the quality of the insulation has not deteriorated during the erection of the MCC.

Particulars of the site tests and field checkouts and the results shall be recorded and incorporated on site reports.

### Low Voltage Induction Motors

Motors shall comply with Eskom Standard Specification GGS 0802, latest revision.

### Earthing and Bonding

The existing electrical earthling installation at the mini-sub shall be bonded to the newly installed generator and MCC earth bar to form a common electrical earthling system.

All steel structures shall be bonded to this common earthing electrode installation.

## Control and Instrumentation engineering works

The C&I scope of work design provides monitoring of the Sewage plant at the existing Outside Plant control room (OPCR). The Employer’s process control and operating philosophy describes the control and monitoring requirements.

### General C&I Requirements

The following general design requirements are applicable to all aspects of the C&I design:

1. All field equipment is to be installed in a suitable location.
2. The *Contractor* shall ensure field equipment operates in an environment within the parameters stipulated by the manufacturer.
3. Where harsh environmental conditions are unavoidable, the field equipment shall be designed for operation in that environment.
4. All IP ratings are as per SANS 60529
5. All supplied field equipment, excluding Junction Boxes (JBs) and their electrical connections are rated IP 65 or better.
6. Field equipment situated outdoors, or in adverse environments, must be provided with additional protection hoods and enclosures.
7. All supplied field equipment operates over an ambient temperature range of: -10°C to 70°C.
8. The equipment layout shall be such that when mechanical work is performed, no C&I equipment shall be damaged.
9. The supplied field equipment provided shall be standardised to the maximum extent possible
10. The *Contractor* as part of the scope of work provides a detailed design report prior to execution of the works during the detail design scope freeze.
11. All the documents required to be submitted by the *Contractor* during the design freeze shall be supplied as part of design data pack.

### Installation requirements for the instrument, transducer, transmitter and junction box location and support

#### Level transmitters and radio installation requirements

#### All field equipment (level transmitters and radios) shall be installed in accordance with the manufactures’ instructions, the requirements of this specification and good practices.

#### All field equipment shall be installed with due regard for the following:

#### Passageways and environment of people and equipment during maintenance activities

#### Ergonomics and maintenance access to equipment

#### Field equipment supports shall not be welded to vessels or handrail, but shall utilise self supported racks with integrated cable and tubing trunking.

#### Junction boxes in close proximity of each other shall be installed on the same level with even spacing between instruments and transducers

#### All instrument and transducers installation shall be free from vibrations

* The contractor shall design a panel that enhouse the 24VDC power supply, transmitter with local display and a radio and an antenna setup.
* The Contractor shall design brackets for transducers and antennas to ensure stability and accuracy in for measurements purposes
* The contractor shall ensure that the panel stand at no less 1.5 m level above ground such that no Eskom personal working on the panel will be required to bend. All indication instruments shall be orientated to permit viewing from walkways or platforms.
* All instruments shall be installed away from potential fire risks, hot environments and sources of radiation.
* Instruments shall normally be accessible for adjustment or maintenance from the permanent walkways or platforms without the need for any temporary access equipment such as ladders, platform or scaffolding.

#### Accessibility

All filed equipment including instrumentation, transducers, transmitters and junctions boxes shall be accessible for servicing from the floor level, walkways, permanent ladders or platforms

#### Instrument cable installation requirements

All instrument cabling shall conform to the requirements of Eskom Standard 240-56227433. Instrument cabling shall be installed with due respect for safety, reliability, access, maintenance, environmental conditions and best practices. All cabling shall be suitably protected against mechanical damage, chemical, dust build-up and heat.

* All instrument cables shall only be terminated on instruments or junction boxes
* All cables connected to instruments shall be installed with a loop of cable to provide sufficient slack for remaking the cable connection if the instrument is removed and to allow for removal of the instruments without electrical disconnection
* Instrument cables shall be routed separately from electrical power cables and crossovers that bring signal and power cables into close proximity shall be right at right angles.
* Trunk cabling between the field equipment transducers and the junction box/ panels shall run in trenches where above ground cable routes cannot be utilised.
* All power supply (220VAC) cables shall be buried/laid on a bed of sand 150mm deep trenches
* The contractor shall identify the route for laying power cables after having performed underground scanning.
* The contractor shall provide the underground scanning report to the project manager before commencing with any trench digging.
* The contractor shall ensure that the surrounding areas where the trenches run are rehabilitated by levelling after completing the work.
* Contractor shall install permanent cable marker indications on the plant

#### Installation requirements for junction boxes and cables termination

1. All field equipment installations shall firstly comply with the Field Instrumentation installation standard 240- 56355754 and then all requirements of this standard
2. All cable connections at junction boxes and field instruments shall be made using compression crimp connectors when required.

#### Labelling

All Labelling:

1. Shall be permanent
2. Shall be according to the relevant labelling specification as dictated By Configuration Management for the project in question
3. Shall not be affected by maintenance activities and should facilitate the ease of maintenance
4. Shall be consistently and unambiguously used throughout the system
5. Shall be of such a nature as to be easily read and interpreted
6. Durable enough to with expected wear and environmental conditions
7. Coordinated and compatible with:

* Codes and labels on related equipment
* Other coding and labelling within the system

#### Earthling

1. All components of the enclosure i.e. door, terminal plate, gland plate enclosure and earth Bar shall be individually star terminated to earth stud
2. The earth stud shall have all the appropriate nuts, washers, lock washers for proper installation

### Interfacing remote signals onto Human Machine Interface Graphic

The Contractor designs, supplies, installs, commissions and verifies all flowmeters, level meters, remote telemetry sites, and additional PLC I/O modules PLC logic and HMI graphics which will interface with the existing HMI at Matimba Power Station to ensure accurate plant monitoring.

1. The contractor shall be responsible for all the configuration of the signals onto the Matimba Powers Station outside plant HMI system ABB 800xA HMI system.
2. The contractor shall perform all the installations, terminations and commissioning of the radios communication system between the OPCR and Sewage plant.
3. The employer shall provide the contractor with the terminal PLC drawings for terminating all the plant signals on the Rslogix Water Treatment Plant PLC and onto the HMI
4. The contractor shall be responsible for all the terminations on the PLC I/O’s.
5. All terminations onto the PLC I/O modules shall be arranged with the project manager to avail C&I Engineer for supervision.

# List of drawings

## Drawings issued by the *Employer*

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both Works Information and Site Information.

|  |  |
| --- | --- |
| **Drawing number** | **Title** |
| 0.58/37664 | Maturation Pond 1 Upgrade |
| 20.58-14933 | Sewage Treatment Plant P&ID |
| 0.58/380 | Sewage Treatment Works Layout |
| 0.58/384 | Land Acquisition for Escom Sewerage Plant Services Servitude |
| 0.58/385 | Piping and Cables to Escom Sewerage Plant |
| 0.58/395 | R.C. of Chlorination Tank and 14000 DIA. Clarifier |
| 0.58/396 | R.C. Details of Aeration Tank |
| 0.58/397 | Reinf. Detail of Central Base of 14000 DIA Clarifier |
| 0.58/398 | Reinf Schedule of Central Base of 14000 DIA Clarifier |
| 0.58/399 | Reinf Detail to central Column |
| 0.58/400 | Reinf Detail to Ring Footing of 14000 DIA Clarifier |
| 0.58/401 | Reinf Schedule to Ring Footing of 14000 DIA Clarifier |
| 0.58/402 | Reinf Detail of Floor Slab for 14000 DIA Clarifier |
| 0.58/403 | Reinf Schedule of floor slab and sleeper beam; 14000 DIA Clarifier |
| 0.58/404 | Reinf Detail for wall + Launder 14000 DIA Clarifier |
| 0.58/405 | Reinf Schedule of Wall + Launder 14000 DIA Clarifier |
| 0.58/407 | Chlorination Tank Reinf Detail of Bottom Slab |
| 0.58/409 | Chlorination Tank Reinf Detail of Walls 2 + 3 |
| 0.58/410 | Chlorination Tank Reinf Detail of Walls 4 + 5 |
| 0.58/411 | Chlorination Tank Reinf Detail of Walls 6 - 9 |
| 0.58/412 | Chlorination Tank Reinf Detail to Wall 10 & Slabs A + B |
| 0.58/413 | General Arrangement of Structures and Pipes |
| 0.58/439 | R.C. Details of balancing Pond |
| 0.58/441 | Aeration Tank Layout Showing Sleeper Beam Numbers |
| 0.58/442 | Aeration Tank Sleeper Beams 1-6 |
| 0.58/443 | Aeration Tank Sleeper Beams 7&8 |
| 0.58/444 | Aeration Tank Sleeper Beam 9 |
| 0.58/445 | Aeration Tank Floor Slab & Column Starters |
| 0.58/446 | Aeration Tank Columns |
| 0.58/447 | Aeration Tank 160THK Walkway Slab |
| 0.58/448 | Aeration Tank 160THK Walkway Slab |
| 0.58/449 | Aeration Tank Fixing of Sidewall Slab Reinforcement |
| 0.58/450 | Aeration Tank Sidewall Slabs |
| 0.58/451 | Aeration Tank Sidewall Slabs |
| 0.58/452 | Aeration Tank Sidewall Slabs |
| 0.58/453 | Aeration Tank Sidewall Slabs |
| 0.58/457 | Sludge Drying Beds: Sumps |
| 0.58/458 | Maturation Pond “Wier” Slab in Outlet Chamber |
| 0.58/459 | Maturation Pond Walkway Over Outlet Chamber |
| 0.58/485 | Raw Sewage Pump Station Arrangement |
| 0.58/487 | Balancing pond Additional Reinforcement Bars |
| 0.58/571 | R.C. Details of Pump Station |
| 0.58/624 | Pump Station Slabs at +868,162 |
| 0.58/625 | Pump Station Sump Walls |
| 0.58/626 | Pump Station Reinf. Placement in Surface Bed |
| 0.58/627 | Pump Station Slab Reinforcement |
| 0.58/628 | Pump Station Slab Reinforcement |
| 0.58/629 | Aeration Tank Beams at +9300 |
| 0.58/705 | Transfer Pump Station Plan, Sections & Elevations |
| 0.58/807 | Transfer Pump Station R.C. Details |
| 0.58/11610 | Raw Sewage Pump Station Details of Screening Bucket |
| 0.58/11611 | Arrangement of Sludge Pump Station |
| 0.58/11612 | Aerator Fixing Details |
| 1063-03 | Arrangement of Transfer Pumps |
| 1063-11 | Civil Detail of 14000DIA Clarifier, Chlorination Tank & Sludge Sump |

C3.2 *Contractor*’s Works Information

|  |
| --- |
| This section of the Works Information will always be contract specific depending on the nature of the *works*.  It is most likely to be required for design and construct contracts where the tendering contractor will have proposed specifications and schedules for items of Plant and Materials and workmanship, which once accepted by the *Employer* prior to award of contract now become obligations of the *Contractor* per core clause 20.1.  Typical sub headings could be  a) *Contractor*’s design  b) Plant and Materials specifications and schedules  c) Other |

This section could also be compiled as a separate file.