



**Johannesburg Water SOC Ltd**



**BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN**

**VOLUME 2**

**PART 3: SCOPE OF WORK**

Employer:		Contractor:	
Witness:		Witness:	



## C3: SCOPE OF WORK

### Portion 1: Project Specifications

#### PS 1 DESCRIPTION OF THE WORKS

##### PS 1.1 Employer's Objectives

Johannesburg Water wishes to appoint a single multidisciplinary Contractor to perform the work required to carry out the Infrastructure Renewal Plan at the Bushkoppie Wastewater treatment Works (BWwTW).

Zitholele Consulting has been tasked by Johannesburg Water, under the Johannesburg Water Bulk Waste Panel appointment, to execute the role of Employer's Agent for the implementation of the IRP at the BWwTW.

##### PS 1.2 Overview of the Works

The scope of this contract includes civil, building, structural, mechanical, electrical & control and instrumentation work and includes the following:

The objective of the project is to undertake refurbishment/replacement/upgrade at the following areas at the BWwTW.

- Head of Works Module 1
- Head of Works Module 2
- Primary Sedimentation Tanks
- Fermenters
- Bio-Reactor Units 1 to 4
- Clarifiers Units 1 to 4 (3 clarifiers per unit)
- Belt Press Building
- Wash Water Pump Station
- Final Effluent Pump Station
- Lime Plant
- Emergency Overflow Dam
- Internal Access Roads
- New Wash Water Filter Station to replace the inline filter
- Substations

Employer:		Contractor:	
Witness:		Witness:	



### PS 1.3

- Security Upgrade

#### Scope of Contract

The scope of work under this project will be on a live, operational site and the proposed tenders must therefore take cognisance of this fact when compiling their respective Occupational Health and Safety Plans and shall accommodate appropriate working procedures. It is considered essential that the final effluent quality shall take precedence over the Contractor's rate of progress when performing the work and the Contractor shall in the construction programme make adequate allowance, therefore. The scope of work to be performed under this contract shall consist of the following:

#### 1. Main Inlet Channel

##### 1.1 Background

The Main Inlet Channel is currently fully operational. Works is required to enable flow measurement and the removal of large debris to protect equipment downstream.

##### 1.2 Scope of Work

###### 1.2.1 Inlet Channel before split to HoW Module 1 & 2

###### 1.2.1.1 Civil Work

- Installation of Trash Screen, bypass and associated infrastructure
- Installation of measuring flume in main inlet channel
- Preparation of channel for Installation of Sluice Gates upstream and downstream of the Trash Screen.

###### 1.2.1.2 Mechanical Equipment

- Installation of flow measurement device at flume
- Installation of Sluice Gates upstream and downstream of the Trash Screen

#### 2. Refurbish Head of Works Module 1

##### 2.1 Background

This Module is currently not in operation due to equipment failure; therefore, all sections require refurbishment or replacement of equipment.

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Witness:		Witness:	



## 2.2 Scope of Work

### 2.2.1 Inlet Channel to Coarse Screens

#### 2.2.1.1 Civil Work

- Channel to be cleaned.
- Existing expansion joints to be repaired.

#### 2.2.1.2 Mechanical & Electrical

- Sluice gate at inlet to Module 1 HoW to be refurbished and actuated with modulating action.
- Flow meter to be installed at venturi flume.

### 2.2.2 Coarse Screens Area

#### 2.2.2.1 Civil Work

- Channels to be cleaned
- Existing expansion joints to be repaired.
- Eroded existing concrete to be repaired.
- Plate blocking flow to bypass channel to be removed.
- Manual screen at bypass channel to be inspected for refurbishment or replacement.
- The concrete bunded area needs to be enlarged to cater for two washer compactors.
- Existing Handrailing to be refurbished.

#### 2.2.2.2 Mechanical & Electrical

- Mechanical Coarse screens (2No.) to be inspected for total refurbishment or replacement.
- Screen field of both Mechanical Screens to be replaced with 12mm apertures.
- Screenings screw conveyor to be replaced with a Hydro Conveyor.
- Mechanical Compactor to be replaced with 2 No. washer compactors.
- Screenings swivel conveyor to be refurbished or replaced.
- Existing 3 No. motorised Bin dollies to be refurbished.
- Washwater system to be upgraded.

Employer:		Contractor:	
Witness:		Witness:	



- The inlet and outlet sluice gates at each screen to be refurbished and electric actuators added (only open & close).

## **2.2.3 Degritting Area**

### **2.2.3.1 Civil Work**

- All four Degritters and channels to be cleaned.
- Existing expansion joints to be repaired.
- Eroded existing concrete to be repaired.
- Washwater system to be upgraded.
- The concrete bunded area needs to be enlarged to cater for two classifiers.
- Existing Handrailing to be refurbished

### **2.2.3.2 Mechanical & Electrical**

- Blowers in Blower building to be replaced with 8 no. new Blowers, two no. for each degritter (one duty/one standby).
- Air piping to be upgraded from new blowers to degritters where each degritter will have its own air supply from their dedicated duty & standby blowers.
- Compressed air system in Compressor Room (Compressors and Receiver) to be upgraded.
- Compressed air piping to be upgraded.
- Existing channel type grit classifiers to be decommissioned and equipment removed.
- Existing SS grit classifier to be replaced with two no. washer type grit classifiers, one duty and one standby.
- Existing swivel conveyor to be refurbished or replaced.
- Existing 4 no. motorised bin dolleys to be refurbished.
- Existing sluice gates to be refurbished

## **2.2.4 Fine Screening Area**

### **2.2.4.1 Civil Work**

- Concrete channels to be cleaned

Employer:		Contractor:	
Witness:		Witness:	

- Existing expansion joints to be repaired.
- Eroded existing concrete to be repaired.
- Existing Handrailing to be refurbished.

#### 2.2.4.2 Mechanical & Electrical

- Existing four no. mechanical fine screens to be inspected for refurbishment or replacement.
- Existing screen field of mechanical screens to be replaced with new screen fields with 6mm openings.
- Existing screenings conveyors to be replaced with hydro conveyors.
- Existing compactors to be replaced with washer compactors.
- Control valve to be installed in hydro conveyor to divert flow to compactor no. 1 or 2.
- Existing swivel conveyor to be refurbished or replaced.
- Existing 3no. motorised Bin dolleys to be refurbished.
- Inlet and Outlet Sluice Gates at each screen to be refurbished and actuators replaced.

### 3. Refurbish Head of Works Module 2

#### 3.1 Background

HoW Module 2 has been in operation since the year 2000 and it was equipped with a coarse and fine screening and a degritting facility. Later the screening was revised to only one set of screens as the two sets of screens were too close to each other.

The existing Blower House serves both HoW Modules 1 and 2 Degritters with a common air pipe from the Blowers and air supply to Module 1 Degritters taps of this pipe. This project's aim is to have dedicated blowers for each Degritter and because the existing Blower House is too small to accommodate 16 no. blowers, blowers for Module 2 Degritters will be housed in a new Building near the Degritters.

The grit accumulated at Module 2 Degritters and classifiers is currently transferred to the bins at Module 1 and included in this project are new Classifiers and a dedicated motorised bin area for Module 2.

#### 3.2 Scope of work

Employer:		Contractor:	
Witness:		Witness:	



### **3.2.1 Coarse Screens Area**

#### **3.2.1.1 Mechanical Work**

- The existing 4 no. Mechanical Screens need to be replaced with similar front raked screens with a screen field with 12mm apertures.
- The existing Hydraulic Conveyor needs to be refurbished
- The existing 2 no. Washer Compactors needs to be refurbished
- The existing Conveyor that transfers the washed screenings to the selected bin needs to be refurbished
- Existing 3 no. motorised Bin dolley system to be refurbished
- Existing Rails for the bin dollies to be refurbished and stops added
- Existing Actuated Inlet and Outlet Sluice Gates at each screen to be refurbished

#### **3.2.1.2 Civil Work**

- Concrete of the bin area need to be repaired and expansion joints refurbished
- Existing Handrailing to be refurbished
- Steel grating over openings to be refurbished / replaced

### **3.2.2 Degritting Area**

#### **3.2.2.1 Civil Work**

- Existing Handrailing to be refurbished
- New Blower Building to be constructed
- The existing concrete channel type classifiers must be decommissioned and demolished if space is required for new Classifiers
- New Rails (with emergency stops on both ends) for the bin dollies to be installed inside the bunded area.
- A new bunded area to be created around the grit collection, handling and transfer into bins.

#### **3.2.2.2 Mechanical Work**

Employer:		Contractor:	
Witness:		Witness:	



- 8 No new air blowers must be installed in a new Blower Building placed close to the existing Degritters.
- Existing air piping to be replaced with new air piping from the new blowers. Each set of two no. blowers must be dedicated to a Degritter as duty and standby.
- Washwater system must be upgraded.
- Compressed air piping must be upgraded.
- The existing concrete channel type classifiers must be decommissioned and replaced with SS type washer classifiers.
- The existing grit slurry piping must be upgraded from the Degritters to the new grit Classifiers.
- New overflow piping from the new grit classifiers to upstream of the Degritters
- A new swivel type conveyor to be installed to transfer the grit from the Classifier to the duty Bin.
- New motorised bin dolley system next to the new Classifiers and swivel type conveyor.
- Existing actuated Sluice Gates to be refurbished.

#### **4. Refurbishment at Primary Sedimentation Tanks**

##### **4.1 Background**

The Works have 5 no. Primary Sedimentation Tanks (PST's) where refurbishment of the mechanical equipment and the concrete structure is required. The PST's are 35m in diameter and have an outlet launder with a v-notch weir plate on the inside of the tank. All five PST's only have half bridges but PST's 1 to 4 are run by peripheral drive and PST 5 by centre drive.

##### **4.2 Scope of Work**

###### **4.2.1 Mechanical & Electrical**

- The Bridge must be inspected for possible refurbishment or replacement.
- The scum scraper system, including the scum scraper and scum trough must be replaced.

Employer:		Contractor:	
Witness:		Witness:	



- The sludge scraper system must be replaced.
- The slew bearing, slip ring attachment and the slip ring collector need to be replaced.

#### 4.2.2 Civil Work

- The concrete of the launders need refurbishment as the aggregates are exposed.
- The expansion joints in the concrete floors need to be resealed.

### 5. Refurbishment at Fermenters

#### 5.1 Background

The Works have 2 no. Fermenter Tanks where refurbishment of the mechanical equipment and the concrete structure is required. The Fermenters are 25m in diameter and have an outlet launder with a v-notch weir plate on the inside of the tank. Both Fermenters only have half bridges with peripheral drive.

#### 5.2 Scope of Work

##### 5.2.1 Mechanical & Electrical

- The Bridge must be inspected for possible refurbishment or replacement.
- The scum scraper system, including the scum scraper and scum trough must be replaced.
- The sludge scraper system must be replaced.
- The slew bearing, slip ring attachment and the slip ring collector need to be replaced.

##### 5.2.2 Civil Work

- The concrete of the launders and the outlet boxes need refurbishment as the aggregates are exposed.
- The expansion joints in the concrete floors need to be resealed.

Employer:		Contractor:	
Witness:		Witness:	



## **6. Refurbishment at Bio-Reactors**

### **6.1 Background**

The Works have four no. Bio-Reactors where aeration is done by diffused air which was previously refurbished and the mixers is now due for refurbishment. The bearings of the screw pumps that returns the sludge from the Clarifiers back to the Bio-Reactor also requires refurbishment.

Flow measurement and the split of the flow to the four Bio-Reactors requires upgrading to make it more efficient.

### **6.2 Scope of Work**

#### **6.2.1 Mechanical & Electrical**

- The mixers in the Anaerobic Basins, (2 per Bio-Reactor and 8 no. in total) must be replaced.
- The mixers in the Anoxic Basins, (2 per Bio-Reactor and 8 no. in total) must be replaced.
- Flow measurement in the channels to each Bio-Reactor.
- Replace bottom bearings of 3 No. Screw Pumps at each Bio-Reactor (12no. total) with permanently lubricated (ECO) bearings.
- Replace top bearing of 3 No. Screw Pumps at each Bio-Reactor (12no. total) with bearings connected to the lubrication system.

## **7. Refurbishment at Clarifiers**

### **7.1 Background**

The Works have 12 no. Clarifiers, 3 no. per Bio-Reactor where refurbishment of the mechanical equipment and the concrete structure is required. The Clarifiers are 30m in diameter and have an internal outlet launder with v-notch weir plates on either side. Because of the internal launder there are two scum removal systems per Clarifier. The sludge and scum scrapers hang from full bridges which are run by peripheral drive with one motor on one end.

### **7.2 Scope of Work**

#### **7.2.1 Mechanical & Electrical**

Employer:		Contractor:	
Witness:		Witness:	



- The Bridge must be inspected for possible refurbishment or replacement.
- The scum scraper system, including the scum scraper and scum trough must be replaced.
- The sludge scraper system must be replaced.
- The slew bearing, slip ring attachment and the slip ring collector need to be replaced.

#### 7.2.2 Civil Work

- The concrete of the launders need refurbishment as the aggregates are exposed.
- The expansion joints in the concrete floors need to be resealed.

### 8. Refurbishment at Wash Water Pump Station

#### 8.1 Background

The Wash Water Pump Station was commissioned more than 20 years ago, therefore it requires urgent refurbishment. Inside the Pump Station are 4no. fibre glass pressurized sand filters that filters the final effluent extracted from the channel before the discharge point. There are two Filter booster pumps to pump the effluent into the filters and the filtered water discharges into a galvanized steel tank outside the building the tank has some rust and panels need to be replaced. There are currently 3no. wash water transfer pumps that withdraws the filtered water from the steel tank outside the building and delivers it at the HoW using a pressurised tank to ensure the water is at a certain head at the discharge points.

#### 8.2 Scope of Work

##### 8.2.1 Mechanical & Electrical

- Replace the 4no. pressurised reinforced polyester & fibre glass sand filters with new sand filters.
- Replace the 2no. Filter booster pumps, suction and discharge piping including all the required manual and control valves for a one duty and one standby filter system.

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- Replace the three wash water transfer pumps, suction and discharge piping including all the required manual and control valves inside the pump station to run on a one duty and two standby system.
- Replace the existing Sump Pump in the dry well of the pump station.
- Install a generator to supply electricity during power failures for continuous wash water supply to HoW.

### 8.2.2 Civil Work

- Replace the existing galvanised steel tank with a new larger tank.
- Repair the roof trusses and roof sheeting of the building.
- Modifications to the MCC room.
- Modifications to pump plinths to suit new pumps.

## 9. Refurbishment at Final Effluent Pump Station

### 9.1 Background

The Final Effluent Pump Station was constructed and commissioned as part of the Sludge Handling project in 2013. The Pump Station houses two sets of pumps, one set to deliver wash water to the Lime Plant, final Clarifiers and sludge screenings building and one set to deliver wash water to the Belt Press Building. Refurbishment and upgrading is required on the delivery of wash water to the Belt Press building as the two pumps operates mainly as duty assist, therefore there is no standby pump.

### 9.2 Scope of Work

#### 9.2.1 Mechanical & Electrical

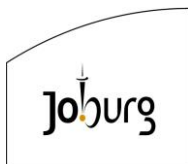
- The position of the clamp-on flow meter needs to be changed.
- The pressure control valve needs to be replaced.
- The VSD's controlling the pumps need to be programmed by Siemens.

## 10. Refurbishment at Belt Press Building and WAS Pump Station

### 10.1 Background

The Belt Press Building houses 6no. Belt Presses to dewater the sludge before placing it on the Sludge Drying Beds. The floor at the entrance and at the rear

Employer:		Contractor:	
Witness:		Witness:	



of the belt presses need attention as water is standing and the area becomes slippery which will result in accidents.

The existing inline filter on the wash water supply to the Belt Presses is not adequate to ensure that the wash water is clean enough for the Belt Presses and will be replaced with new sand filters in the new Wash Water Filter Station. Flooding occurs at the WAS Pump Station when the return Pumps to the HoW are out of order.

## **10.2 Scope of Work**

### **10.2.1 Civil Work**

- Add screed on the area where the water is standing.
- An actuated valve needs to be installed in the WAS Pump Station on the overflow from the Lime Clarifiers to the HoW Return Pumps.

## **11. Refurbishment and Upgrade of the Lime Plant**

### **11.1 Background**

The Lime Plant was constructed with the Sludge Handling Project and commissioned in 2014. The mixers in the Lime Reactor requires attention as they are not working well, and the lime make-up and dosing need to be upgraded.

## **11.2 Scope of Work**

### **11.2.1 Civil Work**

- Move the Silo further away from the Lime Reactor to create space for the larger lime make-up tanks.
- Demolish existing bunded area
- Construct new bunded area and plinths for the Lime Silo and Make-up Tanks

### **11.2.2 Mechanical & Electrical**

- Replace the flash mixer in the inlet box of the lime reactor
- Replace the four mixers in the lime reactor.
- Supply and install two lime screw feeders.
- Supply and install two new lime make-up tanks with mixers.

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Witness:		Witness:	



- Supply and install a new lime dosing to the Lime Reactor Inlet Box

## **12. Refurbishment at Emergency Overflow Dam**

### **12.1 Background**

The Emergency Overflow Dam and Pump Station was commissioned in Nov 1999 but due to the locality of the infrastructure vandalism occurs on a regular basis where exposed cabling to the level control and the overflow measurement are damaged or stolen.

### **12.2 Scope of Work**

#### **12.2.1 Civil Work**

- Construct a channel and weir in the existing overflow channel.
- Construct a concrete box to house the new flow measurement instrumentation.

#### **12.2.2 Mechanical Work**

- Install new level control of the pumps inside the Pump Station.

## **13. Refurbishment of internal Roads**

### **13.1 Background**

Most of the internal asphalt roads were done with the initial construction of the works which was in the 1980's and therefore require urgent attention.

### **13.2 Scope of Work**

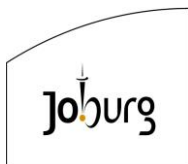
- Repair cracks in the roads.
- Repair of potholes in ten roads
- Chip and spray where required.

## **14. New Wash Water Filter Station**

### **14.1 Background**

The inline filter at the Belt Press Building is not capable of handling the high solids content in the final effluent, therefore sand filters will be installed in a new Filter Station next to the Final Effluent Pump Station.

Employer:		Contractor:	
Witness:		Witness:	



## 14.2 Scope of Work

### 14.2.1 Civil Work

- Construct a new masonry building with concrete tiled roof.
- Construct an effluent sump with a pipe connected to the existing effluent pipe feeding the sump at the Final Effluent Pump Station.
- Supply and install delivery piping from the Sand Filters to the sump at the Final effluent pump station.

### 14.2.2 Mechanical & Electrical

- Supply and install four (3 duty and one standby for backwash) pressurised sand filters fed with two booster pumps (one duty and one standby) and two blowers (one duty and one standby) including piping with actuated valves.

## 15. Electrical Refurbishment

### 15.1 Background

The electrical refurbishment consists of work at 6 x MV Substations, Trash Screen at the Inlet Cannel, HoW Module 1 Coarse Screens, HoW Module 1 Grit Handling including Blowers & Compressors, HoW Module 1 Fine Screens, HoW Module 2 Coarse Screens, Module 2 Grit Handling including new Blowers and Compressors in a new Building and new skips / bins, new Emergency Generator, Five Primary Sedimentation Tanks, Three Primary Sludge Pump Stations, Two Fermenters, Fermented Sludge Pump Station, Mixers at the Bio Reactors, Secondary Clarifiers, Wash Water Pump Station, Lime Plant and new Filter Station & Equipment.

### 15.2 Scope of Work

- 11kV 630A RMU's
- 11kV 800A metal clad vacuum circuit breakers.
- Programming of incomer / feeder & motor protection relays.
- 11kV / 110V 200VA VT panel.
- Battery Tripping Unit (BTU)
- MV cabling and termination.
- MV cable jointing.

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- Cable route markers.
- Excavation & backfilling of cable trenches.
- LV cable and termination.
- Motor stop start stations including pedestals.
- LV control panels.
- MCC panels.
- Re-equipping of motor starter drive cubicles.
- Junction boxes.
- Limit switches.
- Proximity switches.
- Earth conductors.
- Cable ladders.
- Emergency standby generator.
- As-built drawings & cable schedules.
- FAT of all equipment and the issuing of relevant test certificates as per specification.
- & M manuals
- Pressure tests of all cables after installation

## 16. Control and Instrumentation (C & I) Refurbishment

### 16.1 Background

The scope of supply of the instrumentation part of this contract shall be the manufacturing, supply, delivery, safe storage on site before installation, installation and commissioning of the process monitoring and control instrumentation systems listed in this tender document and on the relevant drawings.

### 16.2 Scope of Work

The instrumentation equipment shall include the following:

- The supply, installation and commissioning of 15 level meters (1 hydrostatic pressure and 14 ultrasonic level).

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- The supply, installation and commissioning of 14 flow meters (6 flume, 4 clamp-on, 3 weir and 1 magnetic flow meter).
- The supply, installation and commissioning of 4 pressure meters
- The supply, installation and commissioning of 1 pH meter
- The supply, installation and commissioning of 1 low level switch and 2 pressure switches
- The supply, installation and commissioning of IJBs for 38 motorised open/close valves
- The supply, installation and commissioning of IJBs for 2 motorised diverter gates
- The supply, installation and commissioning of IJBs for 38 motorised modulating valves
- The supply, installation and commissioning of IJBs for 36 solenoid valves
- The supply, installation and commissioning of instrument junction boxes (IJBs) for all instruments supplied (valves and penstocks are supplied and installed by others).
- The manufacture, supply and installation of support steel work for field junction boxes (FJBs) and instrument control panels (ICPs).
- The supply, delivery and installation of the PLC hardware as specified.
- The supply, delivery, installation, splicing and testing of fibre patch panels.
- The supply, delivery, installation, splicing and termination of data communication fibre-optic cables.

The scope of work will further include the removal of all existing old cabling, old racking, old instrument panels and old junction boxes from the following areas:

- Unit 1 Head of Works
- Lime Plant
- Wash Water Pump Station

The scope of work will also include the setting up and programming of two existing Siemens VSDs (Variable Speed Drives) for two 90kW Final Effluent

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centrifugal pumps. These pumps and VSDs were installed some time ago, but because the VSDs were never set up properly, the pumps continue having problems because they run at incorrect speeds.

#### **PS 1.4 Location of the Works**

The equipment called for under this Contract will be installed at the Bushkoppie Wastewater Treatment Works which is located at the following coordinates:

26°18'41.34"S

27°55'50.06"E

#### **PS 1.5 Temporary Works**

No equipment intended for permanent installation shall be operated for temporary purpose without the written permission of and in complete agreement with stipulations as set forth by the Employer's Agent.

The Contractor shall provide all necessary temporary drainage works, temporary pumps and other equipment as might be required for the protection, drainage and dewatering of the Works.

The Contractor shall construct and maintain all temporary access, haulage and construction roads, subject to the approval of the Employer's Agent, and permit all those with legitimate business free and unhindered usage of such roads.

### **PS 2 ENGINEERING**

#### **PS 2.1 Employer's Design**

All designs have been completed by Zitholele Consulting (Pty) Ltd on behalf of the Employer.

When and where specific reference is made, or preference shall be given to specified equipment, the Tenderer shall include such as his main offer in the Tender. Should the Tenderer fail to comply with these requirements, this may lead to the disqualification of the tender submitted.

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Tenderers are free to propose alternative equipment to that proposed by the Employer's Agent and, provided that drawings with details of each alternative proposal are submitted with the Tender, such alternative proposals shall be considered in the adjudication of a Tender. Full details of any changes must be included with the tender. The cost of any changes to the Employer's Agent's design shall be for the Contractor's account where full details of the changes were not submitted with the tender.

Tenderers must satisfy themselves that the layouts as proposed by the Employer's Agent suit in all respects the equipment proposed by the Employer's Agent or by the Tenderer as the case may be. Where equipment other than that proposed by the Employer's Agent is accepted, it shall be the sole responsibility of the Contractor to ensure that the associated equipment including pipework is compatible with the accepted material and proposed structures.

In the case of the Employer's Agent 's acceptance of an alternative proposal, the Contractor shall submit in triplicate to the Employer's Agent for his approval, detailed working drawings of the Contractor's alternative design proposal before any related work is executed.

An extension of Time for Completion of the Contract due to time spent on the alteration of the tender drawings to suit the Contractor's alternative proposals or due to time spent in obtaining the Employer's Agent 's approval of such alternatives, shall not be considered.

Acceptance of an alternative proposal or offer shall not relieve the Contractor of any of his obligations in terms of the Contract. The Contractor's cost of preparation and submission of an alternative proposal shall be deemed to be included in the rates tendered for the execution of the Work.

## PS 2.2

### Drawings

Civil, Building and Structural

The drawings listed in the Drawing Schedule in Volume 4 are issued as part of the Contract Documents. Sufficient drawings to enable the Contractor to

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commence work will be issued to the Contractor at the start of the Contract period and further drawings will be issued to the Contractor from time to time as the work progresses.

The original Contract Documents and Drawings shall remain in the custody of Johannesburg Water (JW). The Consultant shall produce copies as and when required by JW and the Contractor.

Three complete copies of all contract drawings and of the Specifications (excluding SANS 1200 and the Standardised Specifications) shall be furnished free of cost to the Contractor for his own use. The Employer's Agent shall within ten days after receipt by him of a request for the same, furnish the Contractor with any details that, in the opinion of the Employer's Agent, are necessary for the execution of any part of the work. Such copies and details shall be properly preserved and kept in good condition to the satisfaction of the Employer's Agent and kept at the Works in the Contractor's charge until completion thereof. The Employer's Agent or his representative shall at all times have reasonable access thereto and all drawings shall be returned to the Employer's Agent by the Contractor on the completion of the Contract.

#### Mechanical, Electrical & C&I

Reduced drawings have been prepared by the Employer's Agent and are included in Volume 4. The drawings are scanned and have no drawing package intelligence. The drawings show the general plan and sectional dimensions of the civil structures into which the mechanical, electrical, control and instrumentation equipment is to be installed. All drawing information must be checked/confirmed by the Contractor against actual information on site, and any discrepancies must be brought to the attention of the Employer's Agent. The design drawings supplied by the Employer's Agent under this contract will have omissions in terms of equipment detail (such as circuit breaker types, surge arrestor types & ratings, instrument types and details, etc.) because these would not be known at the time of tender. It is therefore an explicit requirement of this contract that the successful Contractor keep ONE SET of these drawings updated. Updates can be hand written updates, provided that it is clearly legible. After commissioning, this updated set must be submitted to

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the Employer's Agent to enable updating of all design drawings to "As-Built" status.

The Contractor shall keep and maintain a drawing register on site which shall be made available to the Employer and the Employer's Agent. The register shall reflect the drawing number, title, revision number and for what purpose the drawing was issued, e.g. construction.

Notwithstanding anything provided for in the GCC, the Contractor shall provide fully dimensioned detailed drawings as well as details of imposed loads by the equipment which will enable the Employer's Agent to finalise the civil drawings and details. Co-operation between the Contractor and the Employer's Agent is essential.

The Contractor shall allow a period of four weeks for the Employer's Agent to finalise the civil drawings if necessary.

### **PS 3                    PROCUREMENT**

#### **PS 3.1                Preferential Procurement Procedures**

Please refer to JW10 Empowerment and Preferential Procurement, page RD.22 and complete pages starting on RD.36 to RD.41 in the Returnable Document pages.

#### **PS 3.2                Supply and Delivery of Equipment**

A delivery period of 24 weeks, within which all materials and equipment must be delivered to site, is envisaged. If the Tenderer considers the delivery time of 24 weeks inadequate for particular items, he must specify the delivery period required for each item in the covering letter to this Contract Document, as well as in the Schedule of Deviations.

The term "supply and deliver" of materials and equipment includes the purchase thereof from commercial sources, manufacturing thereof, factory corrosion protection, factory testing, provision of test certificates certifying compliance of the goods in accordance the Specifications, provision of drawings and details, provision of special tools and keys, the handling thereof and delivery to Site, etc., complete in accordance with the specifications.

Employer:		Contractor:	
Witness:		Witness:	



Tender rates must provide for all the costs by the Contractor to "supply and deliver".

No other payment for materials and equipment shall be considered other than that under the "supply and deliver" items in the Schedule of Quantities.

#### **PS 3.2.1 Purchasing of Equipment**

The Contractor is required to purchase the materials and equipment necessary for the Contract at the earliest possible date thus limiting the effect of inflation. The Contractor must strive to keep the number of suppliers to a minimum.

Payment for materials and equipment shall only be affected if the Contractor can prove ownership of the items.

In the case that off-site storage is agreed by the Employer's Agent and Johannesburg Water then payment shall only be affected if the Contractor can prove ownership and that cession of ownership from the Contractor to Johannesburg Water takes place.

NOTE - It shall be the Contractors responsibility to ensure that the necessary warranties from the equipment suppliers is negotiated such that it only comes into effect on commissioning of the equipment, and acceptance by the Employer's Agent.

#### **PS 3.2.2 Guarantee of Equipment**

It is an express condition of this Contract that the guarantee period on all equipment given by the suppliers to the Contractor shall only commence once the Works is in operation. This stage shall be reached once the Certificate of Completion has been issued.

#### **PS 3.2.3 Particulars of equipment**

The Tenderer shall include comprehensive information covering every item of equipment offered with his Tender. The Employer's Agent shall be able to determine, without reference to the suppliers, any information regarding

Employer:		Contractor:	
Witness:		Witness:	



delivery, drive, power consumption, efficiency, accuracy, etc. applicable under the specified range of operation conditions.

Technical information regarding medium voltage switchgear, motor control centres, busbar trunking, transformers, flow meters, valves, dimensions, etc. shall also be supplied.

Failure to comply with the above requirement may lead to the disqualification of the Tender submitted.

### **PS 3.3 Sub-contracting**

This tender is subject to the sub-contracting condition as described in item 3.11.1 of the Tendering Procedures, as well as the Contract Data, and must be adhered to by the Main Contractor. It is also the obligation of the Main Contractor to impart skills to the Sub-contractor/s on the project during implementation.

NB: all Sub-contractors appointed on this contract must comply with the Central Supplier Database (CSD) requirements, i.e. they must be registered on the CSD.

### **PS 3.4 Specific Construction Method Statements for Tender Evaluation**

The following construction method statements must form part of the tenderer's submission as it will be used during the technical evaluation process.

#### **PS 3.4.1 Installation of the Trash Screen at the Head of Works**

The Tenderer is required to provide a method statement (as part of the tender submission) describing how the trash screen will be installed. The Contractor must take note of the following constraints:

- Flow in the main inlet channel cannot be stopped under any circumstances (i.e. the trash screen will be installed under full flow conditions).
- Due to the position of the screen, flow in the channel cannot be bypassed to the Emergency Overflow Dam.

Employer:		Contractor:	
Witness:		Witness:	



- The Tenderer will be permitted to factor in the proposed new bypass channel and the installation of the sluice gates before and after the Trash Screen in the method statement that is to be developed.
- In the event that a Tenderer is awarded this Contract, the Employer retains sole discretion as to whether this proposed methodology will be implemented during construction. The Employer may require that the Contractor change the methodology proposed, depending on the Employer's requirements.
- The costs associated with the installation are deemed to be included in the Contractor's rates in the BoQ.

#### **PS 3.4.2 Refurbishment of the Existing Sluice gate at the Head of Works**

The Tenderer is required to provide a method statement (as part of the tender submission) describing how the sluice gate to Module 1 Head of Works will be removed for refurbishment to be done. The Contractor must take note of the following constraints:

- Flow in the inlet channel will not be stopped/diverted under any circumstances (i.e., the sluice gate currently stops the flow to Module 1).
- In the event that a Tenderer is awarded this Contract, the Employer retains sole discretion as to whether this proposed methodology will be implemented during construction. The Employer may require that the Contractor change the methodology proposed, depending on the Employer's requirements.
- The costs associated with the installation are deemed to be included in the Contractor's rates in the BoQ.

#### **PS 3.4.3 Installation of Measuring Flume in Existing Main Inflow Channel**

The Tenderer is required to provide a method statement (as part of the tender submission) describing how the precast (or cast in-situ) concrete measuring flume units will be installed in the main inlet channel. The Contractor must take note of the following constraints:

- Flow in the inlet channel will not be stopped/diverted under any circumstances.

Employer:		Contractor:	
Witness:		Witness:	



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- In the event that a Tenderer is awarded this Contract, the Employer retains sole discretion as to whether this proposed methodology will be implemented during construction. The Employer may require that the Contractor change the methodology proposed, depending on the Employer's requirements.
- The costs associated with the installation are deemed to be included in the Contractor's rates in the BoQ.

Employer:		Contractor:	
Witness:		Witness:	



## **PS 4 CONSTRUCTION**

### **PS 4.1 Applicable SANS 1200 Standards**

The Standard Specifications, including the latest updates, for all associated civil work applicable to this Contract shall be (but not limited to):

SANS 1200 A	1986	Section A: General
SANS 1200 AB	1986	Section AB: Engineer's Office
SANS 1200 C	1980	Section C: Site Clearance
SANS 1200 D	1988	Section D: Earthworks
SANS 1200 DB	1986	Section DB: Earthworks (Pipe Trenches)
SANS 1200 DM	1981	Section DM: Earthworks (Roads, Subgrade)
SANS 1200 G	1982	Section G: Concrete (Structural)
SANS 1200 HC	1988	Section HC: Corrosion Protection of Structural Steelwork
SANS 1200 L	1983	Section L : Medium Pressure Pipes
SANS 1200 LB	1983	Section LB : Bedding (Pipes)
SANS 1200 LC	1981	Section LC : Cable Ducts
SANS 1200 ME	1981	Section ME : Subbase
SANS 1200 MM	1984	Section MM: Ancillary Roadworks
SANS 1200 MK	1983	Section MK: Kerbing and Channelling

The Standard Specifications for any associated civil work applicable to this Contract are not issued with this volume but are available at the Contractor's expense from: Standards South Africa,

The Standard Specifications for all associated equipment for the installation of fibre-based cabling applicable to this Contract shall be SANS 10340-1:2006 and SANS 10340-2:2006.

The Standard Specifications for all associated electrical and electronic work applicable to this Contract shall be SANS 10142-1:2003.

These Specifications are not issued with this volume but are available at the Contractor's expense from: Standards South Africa,

#### **Office Address:**

1 Dr Lategan Road; Groenkloof; PRETORIA

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



**Postal Address:**

Private Bag X191; PRETORIA; 0001

**Telephone:**

National: (012) 428-6883 / International: + 27 12 428 6883

**Telefax:**

National: (012) 428-6928 / International: + 27 12 428 6928

Email: [sales@sabs.co.za](mailto:sales@sabs.co.za)

**PS 4.2 Particular Generic Specifications**

The following Particular Generic Specifications forming part of the Contract have been written to cover phases or items of work involving a specialist type of operations or material to be encountered on this Contract and that are not adequately covered by the general specifications.

General	
G01	Colour Coding of Equipment
G02	Corrosion Specification

Civil	
PSU	Building Work
PSVA	Ancillary Work: Landscaping and Grassing
PSVB	Ancillary Work: Fencing

\* The above Civil Specifications are bound in Volume 1 under Scope of Works

Mechanical Works	
M01 Rev5	Mechanical Screens
M02 Rev5	Mechanical Degritter Systems
M03 Rev5	Mechanical Primary Sedimentation Tanks Equipment
M05 Rev5	Mechanical Anaerobic and Anoxic Mixing Equipment
M08 Rev5	Mechanical Gearboxes
M09 Rev5	Mechanical Archimedean Screw Pumps
M10 Rev3	Mechanical Secondary Clarifier Tanks Equipment

Employer:		Contractor:	
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M11 Rev4	Mechanical Fermentation Tanks Equipment
M13 Rev4	Mechanical Sludge Thickener Tanks Equipment
M16 Rev4	Mechanical Conveyor Equipment
M17 Rev4	Mechanical Actuator Equipment
M18 Rev4	Mechanical Centrifugal pumps
M20 Rev4	Mechanical Valves
M21 Rev4	Mechanical Pressure pipework
M22 Rev4	Mechanical hydrated lime handling, Storage, Feeding, Wetting and Dosing equipment
M34 Rev2	Mechanical Sluice / Channel Gates, Adjustable Weirs, Hand Stops and Stop Logs

Electrical Works	
E01 Rev 4	Electrical Motors
E02 Rev 5	Electrical Cable Racks
E03 Rev 5	Electrical Isolator Pushbutton Station (Local start / stop Equipment
E04 Rev 6	Electrical Low Voltage Distribution Boards and Motor Control Centers
E05 Rev 5	Electrical Low Voltage Power and Control Cables
E06 Rev 5	Electrical Medium and Low Voltage Cable Installation
E07 Rev 4	Electrical Industrial Welding Plugs, Couplers & Socket Outlets
E08 Rev 4	Electrical Wiring
E09 Rev 4	Electrical Building Installation
E10 Rev 4	Electrical Busbar Trunking
E11 Rev 5	Electrical Earthing & Lightning Protection
E12 Rev 4	Electrical Medium Voltage Cables
E13 Rev 4	Electrical Medium Voltage Switchgear
E14 Rev 4	Electrical Supply and Installation of a Standby Generator
E15 Rev 4	Electrical Transformer
E16 Rev 4	Electrical Uninterruptable Power Supply Units
E17 Rev 5	Electrical Variable Speed Drive (VSD) Units
E18 Rev 4	Electrical Mini Substations
E19 Rev 2	Electrical 11kV Ring Main Unit
E20 Rev 1	Electrical Overhead Lines up to 22kV
E21 Rev 1	Electrical Lighting and Illumination
E23 Rev 1	Electrical Power Factor Correction
E24 Rev 1	Electrical Battery Tripping Unit
E26 Rev 1	Electrical Colour Coding of Equipment

Employer:		Contractor:	
Witness:		Witness:	



Control & Instrumentation	
Volume 3 Rev15	PLC Panels
Volume 5 Rev14	Clean Power and Surge Protection
Volume 6 Rev 17	Cabling
Volume 7 Rev 15	Networking
Volume 8 Rev18	Flow Measurement
Volume 9 Rev14	Level Measurement
Volume 10 Rev15	pH Measurement
Volume 19 Rev 19	Field Junction Boxes and Panels
Volume 21 Rev11	Load Cells
Volume 23 Rev 8	Pressure Measurement
Volume 25 Rev3	Labelling

The above listed specifications are bound in Volume 2.

#### PS 4.3 Plant and Materials

Johannesburg Water shall have the right to refuse acceptance of any material or workmanship which is found to be unsound, damaged or contrary to the specification, or which is found during the Period of Maintenance or during tests in situ to be defective or in any way contrary to the specification due to causes within the Contractor's control or responsibility. All material or construction rejected by the Employer's Agent shall be replaced or repaired by the Contractor at his own expense to the satisfaction of the Employer's Agent, whose decision with regard to this matter shall be binding on the Contractor.

All materials used shall be the best of their respective kinds and shall be suitable for working at the pressures and temperatures involved under all working conditions, without distortion or deterioration or the setting up of undue stresses in any part and without impairing the efficiency or reliability of the plant and the strength of its component parts. No welding, burning, filling or plugging of defective castings shall be permitted without the Employer's Agent's approval in writing.

#### PS 4.4 Construction Equipment

Construction equipment shall be suited for the onsite intended use and shall conform to all relevant safety aspects required by the OHS Act.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 4.5 Existing Services**

The existing treatment works must remain in operation during the execution of the contract. The Employer must have access to the works at all times. If the work to be done requires the treatment works to be out of operation for a short period, prior arrangements must be made at least two weeks in advance with the Employer's Agent.

There are a number of points of connection to the existing structures, channels, pipelines, as well as electrical and control networks with the new works that should be regarded by the Contractor as being tie-ins to live systems. The Contractor must give the Employer's Agent and the Works Manager two week's written notice of any disruption to the normal plant operations and shall comply with all requirements of the Works Manager in arranging the required connection.

The known existing services are shown on the drawings. The positions of the services cannot be guaranteed. On establishing on Site, the Contractor shall determine the positions of all pipelines and cable routes on Site with the assistance of the Employer's Agent's and the Employer's staff on Site. The Contractor shall take precautions to prevent any damage to existing services.

Any damages which might occur shall be repaired at the cost of the Contractor, to reinstate the services to that of the original status prior to the commencement of the Contract.

#### **PS 4.6 Site Establishment, Facilities Available and Required**

##### **PS 4.6.1 Water Supply for Construction Purposes**

The Contractor shall make a connection to the existing potable water pipeline within approximately 200 meters from the area available for the erection of site offices and stores. Any use of this connection shall be measured, and the Contractor shall be held responsible for payment of the water measured at the current municipal rates. The connection to the existing network shall include an approved water meter (supplied by the Contractor), that will be used to measure the quantity of the water used by the Contractor. The Contractor shall also provide, at his own cost, all connections fittings, pipework, temporary plumbing and pumps necessary to distribute the water on site.

Employer:		Contractor:	
Witness:		Witness:	



Delivery pressures at the take-off points on the water main cannot be guaranteed.

JW does not guarantee continuity of supply and in such cases the Contractor shall make his own provision for standby supplies to maintain continuity. The variation of pressure in the water supply and or breakdown in the supply shall not be grounds for an extension of time or compensation.

Treated effluent for carrying out water tests will be available at the effluent channel near the Final Effluent Pump Station. The Contractor shall make the necessary arrangements for pumping/transferring/transporting, etc. of effluent to the relevant structure for water tightness testing. Used effluent water must be returned and discharged into this channel.

#### **PS 4.6.2 Power Supply for Construction Purposes**

##### **Supply of Electricity**

The Contractor shall make a connection to an existing power distribution point within approximately 200 meters from the area available for the erection of site offices and stores. Any use of this connection shall be measured, and the Contractor shall be held responsible for payment of the amount measured at the current municipal rates. The connection to the existing network shall include an approved meter (supplied by the Contractor), that will be used to measure the power used by the Contractor. The Contractor shall also provide, at his own cost, all transformers, HT and LT cables required to distribute the power on site.

##### **Conditions of Supply**

All installations connected to a supply of electricity provided by JW shall comply with the regulations. Failure to comply with the Safety requirements may lead to immediate disconnection. No connection shall be made to the permanent installation without the prior approval of the Employer's Agent and the Works Manager.

No guarantees of power supply quality are given and power supply breaks of some duration may occur without warning. The Contractor shall make arrangements at his own expense to maintain continuity and quality of power

Employer:		Contractor:	
Witness:		Witness:	



supply. Any breakdown in power supply or reduction of power supply shall not be grounds for an extension of time or compensation.

#### **Application for Supply**

A request for power shall be submitted to the Works Manager via the Employer's Agent at least two weeks before a power supply is required.

#### **PS 4.6.3 Lifting of Equipment**

Lifting equipment is not available on the site.

#### **PS 4.6.4 Site Office, Store and Housing**

The employer shall make available a suitable area for the Contractor's site offices, workshops and stores. The area available may be shown on the Construction drawings. The Contractor shall advise in his tender the area required for site establishment.

Although the security of the treatment works is outsourced by Johannesburg Water to a security firm, the Contractor shall make his own arrangements to secure the facilities as well as the Works provided.

No employees, apart from security guard(s), may be housed on the Site of the Works.

Upon completion of the work in terms of this contract, the site must be cleared of all structures, concrete slabs and waste and excavations must be backfilled. The Contractor must make the necessary arrangements with Johannesburg Water to obtain access for the vehicles and personnel he intends to employ on site.

#### **PS 4.6.5 Telephone Facilities**

The Contractor shall be responsible for arranging his own telephone facilities and shall be responsible for all costs relating thereto.

#### **PS 4.6.6 Ablution Facilities**

Ablution facilities are not available on site. The Contractor shall therefore make the necessary arrangement to provide these facilities. Chemical serviced toilets shall be the minimum acceptable standard. These must be placed in a position to be approved by the Employer's Agent. The facilities must be to the

Employer:		Contractor:	
Witness:		Witness:	



Employer's Agent's approval and must be maintained in a clean and sanitary condition.

**PS 4.6.7 Storage Facilities**

Johannesburg Water has no storage facilities available for use by the Contractor who must make his own arrangements in this regard.

**PS 4.7 Site Facilities Required**

**PS 4.7.1 Facilities for the Employer's Agent**

Two name boards (Provisional Quantity) shall be erected and the boards shall comply with the format and size shown on Drawing No. JW13599R-GEN-003 bound in Volume 2, as a reduced drawing.

No other name board than stated above shall be allowed and on completion of the works, the Contractor shall remove the board from the Site of Works on completion of the maintenance period and prior to the release of retention monies.

**Office Building**

Three offices, complete with furnishings as specified, must be provided by the Contractor for the exclusive use by the Employer's Agent.

The Contractor must consult with the Employer's Agent prior to the supply and erection of the office.

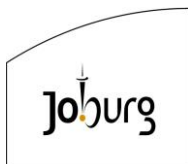
**Carports**

A carport to provide for four motor vehicles shall be provided adjacent to the Employer's Agent 's office for his exclusive use. The carport shall have side cladding and shall be constructed in such a way as to shelter the parked vehicles from the prevailing winds and rain.

**Ablution and Latrine Facilities**

The Contractor shall, in addition to catering for his own staff, provide ablution and latrine facilities adjacent to the Employer's Agent 's office for the exclusive use of the Employer's Agent and his staff. The facilities shall consist of a hand

Employer:		Contractor:	
Witness:		Witness:	



washbasin and a latrine. Serviced Chemical toilets shall be the minimum type of ablution acceptable to the Employer.

The facility shall be maintained in a clean and hygienic condition.

#### First-aid Kit and Protective Clothing

The Contractor shall provide on the Site of Works two first-aid kits to deal with accidents, illnesses and snakebite which may occur during the normal course of Site operations.

The Contractor shall provide two sets of safety helmets and rubber boots for the exclusive use of the Employer's Agent and his staff.

#### Services for Office and Ablutions

The Contractor shall provide, at his own cost, a constant supply of potable water and electric power to the Employer's Agent's office and ablutions.

### **PS 4.8 Measurement and Payment**

The site facilities described in PS 4.7.1 for the Employer's Agent have been provided for in the Preliminary and General Items.

### **PS 4.9 Facilities for the Contractor**

The Contractor must provide, maintain, and remove his own facilities to the satisfaction of the Employer's Agent. The Contractor shall provide the area around his office, stores and sheds (i.e., the "Camp") with adequate security fences to ensure that unauthorised persons do not enter the camp area and security personnel should he deem it necessary.

The Contractor shall provide on-site laboratory facilities necessary to satisfactorily perform all the site control and testing requirements called for in the Contract.

The tendered sums for as scheduled by the Employer's Agent, whether grouped or individually, shall include all costs for the installation, maintenance and removal of the fencing as specified, in addition to all other facilities specified and as required by the Contractor for his own purposes.

Employer:		Contractor:	
Witness:		Witness:	



**PS 4.10 Waste Disposal Sites**

The Contractor shall make his own arrangements for solid and liquid waste disposal. Disposal shall take place at an approved Site. No approved sites are available within the Bushkoppie Works terrain.

**PS 4.11 Site Usage**

Access to the Site is by means of existing gravel / tarred roads from the West. The Contractor shall construct his/her own entrance via the existing fence. The new access point must be strictly controlled by a security guard. No restriction on access to the Site of Works shall be placed on persons or vehicles involved with the execution of the Works. All traffic must be restricted to the maximum speed of 40 km/h and vehicles must be driven with extreme caution. The Contractor shall only make use of the site area as indicated on the drawings or as directed by the Employer's Agent.

The Contractor shall be required to report daily to Management personnel of the Works.

The Contractor's staff shall be identified by either clothing or an identification tag, which shall be displayed when entering the Site of Works.

Movement within the Site of Works is restricted so as to avoid damage to the existing services, structures, trees and, where practical, to the gardens. The making good of any damage caused by non-observance of such restrictions shall be for the Contractor's account.

Access is to be made available to Johannesburg Water's employees to any portion of the site whenever required.

**PS 4.12 Permits and Wayleaves**

Work permits shall be completed and shall be area specific. Permits must be approved by the Employer or Employer's Agent before any work can commence.

As the Contract shall require the removal of equipment from Site, the Contractor shall acquire permits as required by the Employer.

Employer:		Contractor:	
Witness:		Witness:	



No wayleaves are envisaged under the Contract. The Works called for under this Contract shall be executed within the works site boundaries.

**PS 4.13 Alterations, Additions, Extensions and Modifications to Existing Works**

The Contractor must ensure necessary resources and equipment and safety procedures are included in the tender price to carry out this work under the above limitations and shall include the provision of temporary works.

All proposed interruptions and tie-ins to the existing treatment process shall be discussed and agreed with the Employer's Agent and the Works Operational staff. Where necessary, detailed method statements will be required to be provided. Allow four weeks for approval of method statements.

**PS 4.14 Inspection of Adjoining Properties**

The Contract does not require the Contractor to perform inspections of adjoining properties.

**PS 4.15 Survey Control and Setting out of the Works**

The Contractor shall provide permanent beacons marking the main setting out grid lines for all construction works and permanent level benchmarks. An item for this work has been provided in the Bill of Quantities. JW shall not be held responsible if any of the beacons are removed as long as there are other beacons existing.

The Contractor shall take reasonable steps to preserve beacons and benchmarks he has provided.

All necessary pegs, profiles, site rails and other devices required for the setting out of works from the main beacons shall also be supplied and erected by the Contractor to the satisfaction of the Employer's Agent. The cost of these secondary setting out points shall be borne by the Contractor and shall be deemed to be included in his rates and prices.

The Contractor shall be responsible for the setting up, marking and core drilling of holes for the new position of the holding down bolts.

Employer:		Contractor:	
Witness:		Witness:	



**PS 4.16 Accommodation and Care of Employees**

Accommodation will not be provided by JW and the Contractor shall make his own arrangements for accommodation where required.

**PS 4.16.1 Housing**

No employees, apart from security guards, may be housed on the Site of Works. Although the security of the treatment works is outsourced by JW, to a security firm, the Contractor shall make his own arrangements to secure the facilities provided for under the Contract.

The Contractor must make the necessary arrangements with Johannesburg Water to obtain daily access for the vehicles and personnel he intends to employ on site.

**PS 5 MANAGEMENT OF WORKS**

**PS 5.1 Applicable SANS 1921 Standards**

For the purposes of this Contract the following National Standard shall be applicable: -

SANS 1921 -1: 2004 first edition (1): Construction and Management Requirements for Works Contracts: Part 1: General engineering and construction works.

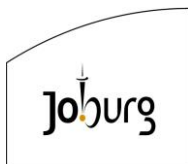
**PS 5.2 Planning and Programming**

**PS 5.2.1 Detailed Programme**

A detailed programme in terms of the General Conditions of Contract clauses 5.6.1 to 5.6.2.7 (as amended in the Contract Specific Data), complete with a cash flow budget for the execution of the works must be made available to the Employer's Agent for approval within 14 days after the receipt of the letter of acceptance. Aspects that shall require co-ordination with the Employer must be indicated clearly and provision must be made for it in the programme.

Special reference is made to Section 5.4 Sequence of the Works, wherein the Employer's specific requirements regarding the sequencing and execution of the Works are described.

Employer:		Contractor:	
Witness:		Witness:	



It is expected that this Contract will be awarded during late 2024/early 2025 and the works must be operational in accordance with the Sequence of Works.

No work of a permanent nature may be executed before the programme has been approved by the Employer's Agent.

The Employer's Agent retains the right to alter, as circumstances may require, the sequence in which installation is to be executed. Such alterations shall only be made after consultation with all parties concerned.

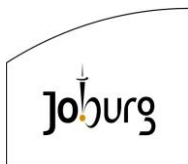
In drawing up the programme, reference shall be made to clauses PS 3.2, PS 4.5, PS 5.3, PS 5.4 and PS 5.7. Also allow for the stipulation that the new works as a whole must be fully operational for an uninterrupted period of 14 days before the equipment shall be considered as being successfully installed and commissioned (PS 5.7).

There will be numerous subcontractors at work on the same site. The Contractor will be required to adjust his programme to accommodate the access and working needs of subcontractors. The Contractor will be required to interface his programme with the programmes of the subcontractors in consultation with the Employer's Agent during the construction period.

The Contractor shall submit with his tender his proposed programme of construction for approval by the Employer's Agent. Thereafter, the Contractor may not deviate from his proposed sequence of construction without the prior approval of the Employer's Agent. The contract programme submitted shall show the manner and order of all proposed work fronts. The Contract programme shall take account of the following:

- The Contractor shall appoint a project programmer / planner for liaison during the Contract.
- No deviation from the approved sequence of construction shall be accepted without prior written approval.
- The programme shall not be in the form of a bar chart only, but shall be in MS project format complete with resources for each activity and show clearly the anticipated quantities of work to be performed each month,

Employer:		Contractor:	
Witness:		Witness:	



together with the anticipated cashflow for each month of the project. The Critical Path Method shall be used to develop the Programme.

- If, during the progress of the work, the quantities of work performed per month fall below those shown on the programme or if the sequence of operations is altered, or if the programme is deviated from in any other way, the Contractor shall, within one week after being notified by the Employer's Agent, submit a revised programme.
- If the programme is to be revised by reason of the Contractor falling behind his programme, he shall produce a revised programme showing the modifications to the original programme necessary to ensure completion of the Works or any part thereof within the time for completion.
- Failure on the part of the Contractor to submit or to work according to the programme or revised programme shall be sufficient reason for the Employer to take steps as provided for in the General Conditions of Contract.
- The approval/acceptance by the Employer's Agent of any programme shall have no contractual significance other than that the Employer's Agent would be satisfied if the work is carried out in accordance to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. It shall not limit the right of the Employer's Agent to instruct the Contractor to vary the programme should circumstances make this necessary.

### **PS 5.3 Methods and Procedures**

The Contractor is to supply detailed method statements, complete with resources as to how he intends to complete the work on the project.

### **PS 5.4 Sequence of the works**

As per Clause 5.6.1 of the General Conditions of Contract the Contractor shall submit for approval to the Employer's Agent, within the time stated in the

Employer:		Contractor:	
Witness:		Witness:	



Contract Data, a detailed programme showing the order of, procedure and method in which he proposes to carry out the Works and as well as his method of measurement of progress.

Details of certain mechanical equipment will have an influence on the final design of certain components and drawings thereof of some of the civil works to be constructed under this contract. The Contractor will, therefore, be required to take this into account in drawing up his programme.

The Contractor shall, whenever required by the Employer's Agent, furnish for his information particulars in writing of the Contractor's arrangements for the carrying out of the works and of the plant and temporary works that the Contractor intends to supply, use or construct as the case may be. The submission to and approval by the Employer's Agent of such programme, or the furnishing of such particulars will not relieve the Contractor of any of his duties or obligations under the contract.

The Tenderer shall submit with his tender separate management and supervisory organisation charts and supervisory and labour histograms as well as an estimated cash flow for the project.

**The Contractor must ensure the following constraints are incorporated into his project programme and reflected in the sequencing of the Works and pricing where required.**

**The Tenderer (Contractor) remains fully responsible for the programming of the Works; whilst adhering to the sequencing requirements of the Employer.**

#### **PS 5.4.1 Overall Construction Sequencing**

The Tenderer is required to adhere to the prescribed sequencing outlined in this section and graphically presented in the corresponding Sequencing Chart of Section PS 5.4.2. The prescribed sequencing accounts for priority work that is required by the Employer, operational considerations for the treatment works and project financial considerations.

Employer:		Contractor:	
Witness:		Witness:	



The following has been included in the contract data must be adhered to:

*The Works shall be programmed to be completed in Sections, such that a Certificate of Practical Completion can be issued for each Section (i.e. different dates of Practical Completion for each of the 2 (two) Sections will apply). .*

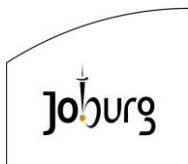
In the following sections, the Scope of Work is described in a summary format. The full extent of each section of the Works is described in other sections of this document, and the Tenderer must read the detailed Scope of Work when compiling the Programme. In each of the Sections described below it should be noted that the Section refers to all Engineering disciplines that will be required for the completion and commissioning of that Section of the Works, including Civil, Mechanical, Electrical and Control & Instrumentation Engineering, to enable a Certificate of Practical Completion to be issued for that Section of the Works.

The Employer has provided indicative durations for the completion and commissioning over the various components and Sections of the Works. However, the Tenderer (Contractor) remains fully responsible for the programming of the Works. The Tenderer may change the durations of activities according to construction requirements. The Tenderer may also change start dates for activities. **HOWEVER, the overall sequencing and logic of the execution of the Works may not differ substantially from that proposed. Should the Tenderer not be able to comply with the sequencing specified, this should be listed as a deviation in the Schedule of Deviations.**

The prescribed sequence requirements are as follows:

Should there be any discrepancy between the items listed below and the Sequencing Chart, the Sequencing Chart shall take preference. Some minor sections of the Works may not have been listed here – the Tenderer is at liberty to programme these minor sections within the overall programme duration.

Employer:		Contractor:	
Witness:		Witness:	



The overall Works has been divided into two Sections, such that “Sectional Completion” as specified in GCC 2015 shall apply. The items of work listed in each Section as described/listed in the Sequencing Chart cannot be changed. Should there be any discrepancy regarding the sequencing of the Works, the provisions of the Sequencing Chart shall apply.

The Employer reserves the right at its absolute discretion to alter the Sequencing of the Works during construction, due to operational (or other) requirements. The Contractor will not be entitled to any additional compensation should the Sequencing of the Works be changed. In general, work on Section 2 can only commence once Section 1 has been completed and commissioned.

#### Main Inlet Channel

- **The Main Inlet Channel** is prescribed to have an Early Start Date (ESD) of **Month 1** and a Completion Date of **Month 4**.

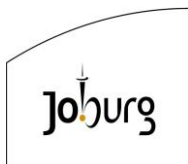
#### Head of Works

- **Head of Works Module 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 18**.
- **Head of Works Module 2** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 36**.

#### Primary Settling Tanks (PSTs)

- **PST 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 6**.
- **PST 2** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 12**.
- **PST 3** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 24**.
- **PST 4** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 30**.

Employer:		Contractor:	
Witness:		Witness:	



- **PST 5** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 36**.

#### Fermenters

- **Fermenter 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 6**.
- **Fermenter 2** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 24**.

#### Reactors

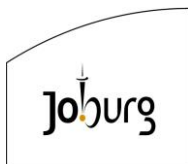
- **Reactor 1 - Mixer 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 3**.
- **Reactor 1 - Mixer 2** is prescribed to have an ESD of **Month 4** and a Completion Date of **Month 6**.
- **Reactor 1 - Mixer 3** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 9**.
- **Reactor 1 - Mixer 4** is prescribed to have an ESD of **Month 10** and a Completion Date of **Month 12**.
- **Reactor 1 – Screw Pump 1 Bearings** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 4**.
- **Reactor 1 – Screw Pump 2 Bearings** is prescribed to have an ESD of **Month 5** and a Completion Date of **Month 8**.
- **Reactor 1 – Screw Pump 3 Bearings** is prescribed to have an ESD of **Month 9** and a Completion Date of **Month 12**.
- **Reactor 1 – Clarifier 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 6**.
- **Reactor 1 – Clarifier 2** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 12**.
- **Reactor 1 – Clarifier 3** is prescribed to have an ESD of **Month 13** and a Completion Date of **Month 18**.

Employer:		Contractor:	
Witness:		Witness:	



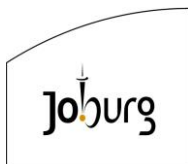
- **Reactor 2 - Mixer 1** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 9**.
- **Reactor 2 - Mixer 2** is prescribed to have an ESD of **Month 10** and a Completion Date of **Month 12**.
- **Reactor 2 - Mixer 3** is prescribed to have an ESD of **Month 13** and a Completion Date of **Month 15**.
- **Reactor 2 - Mixer 4** is prescribed to have an ESD of **Month 16** and a Completion Date of **Month 18**.
- **Reactor 2 – Screw Pump 1 Bearings** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 10**.
- **Reactor 2 – Screw Pump 2 Bearings** is prescribed to have an ESD of **Month 11** and a Completion Date of **Month 14**.
- **Reactor 2 – Screw Pump 3 Bearings** is prescribed to have an ESD of **Month 15** and a Completion Date of **Month 18**.
- **Reactor 2 – Clarifier 1** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 6**.
- **Reactor 2 – Clarifier 2** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 12**.
- **Reactor 2 – Clarifier 3** is prescribed to have an ESD of **Month 13** and a Completion Date of **Month 18**.
- **Reactor 3 - Mixer 1** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 21**.
- **Reactor 3 - Mixer 2** is prescribed to have an ESD of **Month 22** and a Completion Date of **Month 24**.
- **Reactor 3 - Mixer 3** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 27**.
- **Reactor 3 - Mixer 4** is prescribed to have an ESD of **Month 28** and a Completion Date of **Month 30**.

Employer:		Contractor:	
Witness:		Witness:	



- **Reactor 3 – Screw Pump 1 Bearings** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 22**.
- **Reactor 3 – Screw Pump 2 Bearings** is prescribed to have an ESD of **Month 23** and a Completion Date of **Month 26**.
- **Reactor 3 – Screw Pump 3 Bearings** is prescribed to have an ESD of **Month 27** and a Completion Date of **Month 30**.
- **Reactor 3 – Clarifier 1** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 24**.
- **Reactor 3 – Clarifier 2** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 30**.
- **Reactor 3 – Clarifier 3** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 36**.
- **Reactor 4 - Mixer 1** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 27**.
- **Reactor 4 - Mixer 2** is prescribed to have an ESD of **Month 28** and a Completion Date of **Month 30**.
- **Reactor 4 - Mixer 3** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 33**.
- **Reactor 4 - Mixer 4** is prescribed to have an ESD of **Month 34** and a Completion Date of **Month 36**.
- **Reactor 4 – Screw Pump 1 Bearings** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 28**.
- **Reactor 4 – Screw Pump 2 Bearings** is prescribed to have an ESD of **Month 29** and a Completion Date of **Month 32**.
- **Reactor 4 – Screw Pump 3 Bearings** is prescribed to have an ESD of **Month 33** and a Completion Date of **Month 36**.
- **Reactor 4 – Clarifier 1** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 24**.

Employer:		Contractor:	
Witness:		Witness:	



- **Reactor 4 – Clarifier 2** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 30**.
- **Reactor 4 – Clarifier 3** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 36**.

### Lime Treatment

- **Lime Reactor and Silo** is prescribed to have an ESD of **Month 13** and a Completion Date of **Month 18**. The latest completion date can be **Month 24**.
- **Lime Clarifier 1** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 25**.
- **Lime Clarifier 2** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 25**.
- **Lime Clarifier 3** is prescribed to have an ESD of **Month 26** and a Completion Date of **Month 31**.
- **Lime Clarifier 4** is prescribed to have an ESD of **Month 26** and a Completion Date of **Month 31**.

### Washwater System

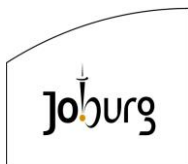
- **Washwater System** (Refer to Sections 2.2.2.2, 2.2.3.1 and 3.2.2) is prescribed to have an ESD of **Month 4** and a Completion Date of **Month 15**.

### Pump Stations

- **Final Effluent Pump Station** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 30**.
- **New Washwater Filter Station** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 12**.

### Substations

Employer:		Contractor:	
Witness:		Witness:	



- **Head of Works Substation** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 12**.
- **Blowers Substation** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 18**.
- **Substation 0** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 24**.
- **Substation 1** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 30**.
- **Substation 2** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 30**.
- **Substation 3** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 12**.
- **Emergency Overflow Dam Mini Substation** is prescribed to have an ESD of **Month 13** and a Completion Date of **Month 15**.

#### Other Works Areas

- **Belt Press Building** is prescribed to have an ESD of **Month 19** and a Completion Date of **Month 20**.
- **11kV Upgrade** is prescribed to have an ESD of **Month 25** and a Completion Date of **Month 36**.
- **Security Upgrade** is prescribed to have an ESD of **Month 1** and a Completion Date of **Month 12**.
- **Emergency Overflow Dam** is prescribed to have an ESD of **Month 7** and a Completion Date of **Month 9**.
- **Internal Access Roads** is prescribed to have an ESD of **Month 31** and a Completion Date of **Month 36**.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 5.4.2 Prescribed Sequencing Chart**

The chart outlines the prescribed sequencing and it should be interpreted as follows:

- A section as referred to PS 5.4.1 and the Contract Data is each of the listed items in the chart. On completion of a section, a Certificate of Practical Completion shall be issued as specified in the Contract Data.
- The ESD for each section shall be fixed.
- Section durations shall be adhered in the sequencing chart.

#### **PS 5.4.3 Conditional Assessments**

The Contractor must include and indicate in his programme the time that will be required by the Contractor to prepare the Conditional Assessment Reports described above.

The programme must also include and indicate a time period for the review and approval of the Conditional Assessment Reports by the Employer and Employer's Agent. A minimum period of 15 working days will be required for this approval.

#### **PS 5.4.4 RAS Pump Stations**

The Client will only be able to stop the inflow to one screw pump of each RAS pump station at a time. Once the Contractor has replaced the bearings of a screw pump with new sealed bearings, he will need to wet commission the screw pump before being given access the next screw. The Contractor must also make the necessary Health and Safety provisions for ensuring that the screw pump can be safely accessed by his work team, whilst the adjacent screw pumps remain in operation.

The Contractor will not be given access to work on more than one screw pump at a time. The Employer will retain sole discretion as to the sequence of the screw pumps that will be made available to the Contractor for refurbishment or replacement.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 5.4.5 Upgrade of Blowers and Modification of Air Lift Pipework**

The Contractor shall only have access to either Module 1 or Module 2 to undertake refurbishment of the blowers and associated air lift pipework. The Contractor will not be given access to both Modules simultaneously. The Contractor shall complete and commission work related to upgrading the blowers and associated pipework for that respective Module in its entirety before being given access to the next Module. This includes all infrastructure and equipment that is required for the operations of the grit removal system.

It should be noted that a new blower building is required for the Module 2 blowers, whilst the Module 1 blowers will be installed in an existing building, after the existing equipment has been removed. The Contractor will need to obtain formal approval from the Employer's Agent permitting him to commence work on the next Module. The Employer will retain sole discretion as to which of the Modules will be made available at any given time to the Contractor for refurbishment.

#### **PS 5.4.6 Washwater Sequencing Restrictions**

Installation of the wash water system to Module 1 & 2 Head of Works will need to be co-ordinated with the Bushkoppie Works Manager. The Contractor must take cognisance of this when preparing the project programme. Whilst the prescribed sequencing has been provided, the following activities will be required (note that this list is provided as an indication of the likely sequencing of activities, but is not a comprehensive nor exhaustive list):

- Decommission the existing sand filters, including mechanical, electrical and instrumentation installation (complete)
- Remove and dispose safely, as necessary
- Refurbish the existing building (as required)
- Install new sand filters, new booster pumps, including all mechanical, electrical and instrumentation installation (complete), as well as civil modifications that may be required
- Test and commission the new sand filters

Employer:		Contractor:	
Witness:		Witness:	



- Replace the existing transfer pumps with new pumps including pipework and valves
- Upgrade the wash water pipeline to the Head of Works
- Replace the existing filtered water tank (outside the building) with a new larger tank
- Install new header tank at the Head of Works
- Test and commission the system, from the wash water feed to the new sand filters, to the upgraded wash water pipeline, to the header tank at the Head of Works (complete)

The Contractor must indicate that these items (and others that the Contractor deems necessary) are adequately catered for in the programme.

#### **PS 5.4.7 Primary Sedimentation Tanks**

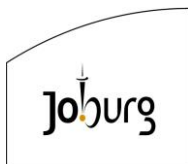
The refurbishment of the Primary Sedimentation Tanks (PST's) will have to be done at one PST at a time. The Contractor will be required to isolate and empty each PST, before commencing work in that PST and its Sludge Pumps. Once refurbishment of a PST and its Sludge Pumps are complete, the Contractor will be given access to the next PST. The Contractor shall sequence the Works accordingly in his project programme. The Employer will retain sole discretion as to which of the PST's will be made available at any given time to the Contractor for refurbishment. However, for planning purposes the Contractor should use the prescribed sequencing.

The refurbishment and adding of an actuator to the sluice gate that isolates a PST will have to be done at the same time refurbishment is done at a PST.

#### **PS 5.4.8 Fermenters**

The refurbishment of the Fermenters will have to be done one at a time. The Contractor will be required to isolate and empty each Fermenter, before commencing work in that Fermenter and its Sludge Pumps. Once refurbishment of a Fermenter and its Sludge Pumps are complete, the Contractor will be given access to the other Fermenter. The Contractor shall sequence the Works accordingly in his project programme. The Employer will

Employer:		Contractor:	
Witness:		Witness:	



retain sole discretion as to which of the Fermenters will be made available at any given time to the Contractor for refurbishment. However, for planning purposes the Contractor should use the prescribed sequencing.

#### **PS 5.4.9 Bioreactors and Clarifiers**

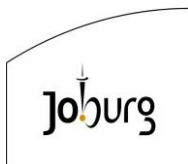
A Bioreactor and its 3 No. Clarifiers operate as a unit and when undertaking refurbishment of a unit, the Contractor will be given access to only one Bioreactor Mixer and one Clarifier at a time. The mixers will have to be removed and re-installed while the Bioreactor is full. The Contractor will be required to isolate and empty each Clarifier, before commencing work in that Clarifier. Once refurbishment of a Clarifier is complete, the Contractor will be given access to the next Clarifier. The Contractor shall sequence the Works accordingly in his project programme. The Employer will retain sole discretion as to which of the clarifiers will be made available at any given time to the Contractor for refurbishment. However, for planning purposes the Contractor should use the prescribed sequencing.

#### **PS 5.4.10 Lime Plant**

The refurbishment of the mixers at the Lime Reactor will have to be done one at a time and while the Reactor is full. The upgrade of the lime make-up and relocation of the Lime Silo can only be done after installation and successful commissioning of a temporary lime dosing system.

The refurbishment of the Lime Clarifiers will have to be done one at a time. The Contractor will be required to isolate and empty each Lime Clarifier, before commencing work in that Lime Clarifier. Once refurbishment of a Lime Clarifier is complete, the Contractor will be given access to the next Lime Clarifier. The Contractor shall sequence the Works accordingly in his project programme. The Employer will retain sole discretion as to which of the Lime Clarifier will be made available at any given time to the Contractor for refurbishment. However, for planning purposes the Contractor should use the prescribed sequencing.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 5.4.11 Final Effluent Pump Station and New WW Filter Station**

Refurbishment of the Final Effluent Pumps that supplies the wash water to the Belt Press Building should be coordinated with the commissioning of the new Wash Water Filter Station. A shut down period should also be arrangement with the Works Manager for the change over of the effluent to the new Wash Water Filter Station and the filtered water to the Final Effluent Pump Station which will transfer it in future to the Belt Press Building. The decommissioning of the inline filter at the Belt Press Building can also be done during the same shut down period.

#### **PS 5.4.12 Emergency Overflow Dam**

The Emergency Overflow Dam is currently operational, i.e., it is filled with raw sewage and may only be partially drained. The Contractor shall assume that he will execute work at the Dam while it is filled with sewage and operational. The Contractor is expected to take this into consideration during his planning of the Works, in particular, Health and Safety requirements. The Contractor will not be permitted to undertake any work in the Dam during the wet season, i.e. the period 1 November to 31 March. This requirement supersedes the prescribed sequencing should there be a conflict (based on the commencement of the works).

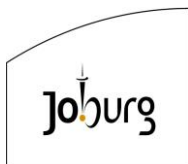
#### **PS 5.4.13 Electrical Constraints**

It is imperative that tenderers examine drawing 18056-73-12-100 (Existing MV reticulation, single line diagram), and drawing 18056-73-12-101 (Proposed MV reticulation, single line diagram) carefully.

These drawings indicate the main 11kV intake substation, which is connected via a spur cable to Sub 3 and the Head of Works Sub. The appointed contractor must do work on these two subs independently from the rest of the substations.

Furthermore, from the main 11kV intake substation there is a cable ring that is connected to the Blower House Substation.

Employer:		Contractor:	
Witness:		Witness:	



It is important that work on the Blower House Substation is undertaken as quickly as possible, as a second cable ring from the Blower House Substation feed Sub 1, Dewatering Plant Sub, Sub 2 and Sub 0.

Sub 1, Dewatering Plant Sub, Sub 2 and Sub 0 can be worked on separately as these subs are on a cable ring, and can be switched off independently from the two supply feeds that enter each Sub.

Tenderers should also note that the existing HOW Compressor MCC & the existing Wash Water Pump Station MCC will be replaced. (It is very possible that these MCC's can be replaced in a 12 hour period).

Furthermore, tenderers should note that numerous starter drives will be replaced and added to the existing MCC's at the Head of Works. Tenderers will have to schedule this work with the electrical foreman at Bushkoppie.

#### **PS 5.4.14 Control and Instrumentation**

1. Unit 1 will have to be completed and working before we can totally shut down unit 2 for the PLC replacement.
2. The pressure sensor in the emergency overflow dam must be inserted in the pipe from the dam. There must be sufficient space so that the pumps do not interfere with the hydrostatic level measurement.
3. The lime treatment will be completely shut down while the PLC is being replaced. This activity will need to be conducted in consultation with the Employer's Agent and Works Manager.

#### **PS 5.5 Software Application for Programming**

All construction programmes for the Completion of the Works shall be submitted to the Employer's Agent in an approved format and software programme. (MS projects is considered acceptable software)

Employer:		Contractor:	
Witness:		Witness:	



## **PS 5.6 Quality Plans and Control**

Quality plans and the control shall be in accordance with the requirements of the Particular Specifications as compiled and included herein after and forming part of the Contract document. These shall be completed and inserted in the data books after commissioning.

## **PS 5.7 Other Contracts and Facilities to Other Contractors And Authorities on Site**

This contract entails civil, mechanical, electrical and control and instrumentation works and shall be awarded to one main Contractor. The main Contractor shall be responsible to co-ordinate all works of a civil, mechanical, electrical and control and instrumentation nature.

It is expected of the Contractor to schedule his work in such a way to ensure optimal completion of the work as a whole. The Employer's Agent retains the right to intervene and prescribe where and when work must be executed in order to ensure a well-coordinated completion of the works as a whole.

Access is to be made available to employees of Johannesburg Water to any portion of the works whenever required for normal operation and maintenance of the existing works.

## **PS 5.8 Testing, Completion, Commissioning and Correction of Defects**

### **PS 5.8.1 Installation and Commissioning**

The Contractor shall be responsible for co-ordinating all works of a civil, mechanical and electrical and control & instrumentation nature, all to the approval of the Employer's Agent. The completion time (in weeks) quoted by the Tenderer must not make provision for any statutory or other holidays which may occur during the contract period. In determining the contractual completion date a week shall be taken to be five (5) working days (Saturdays and Sundays excluded).

Employer:		Contractor:	
Witness:		Witness:	



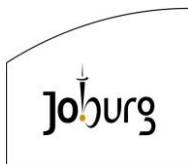
The contractual completion date shall be postponed with a number of days equal to statutory holidays that fall on working days within the actual installation period.

The Contractor shall be responsible for commissioning the equipment which shall comprise putting it into operation, testing, calibration, proper adjustment of the equipment, and thoroughly running it. After the entire installation has been completed and the individual installations have been tested, the Contractor shall commission the equipment supplied and installed by him as required by the Employer's Agent. After the works for each section, as agreed with the Employer's Agent, has been put into operation, the Contractor shall operate the equipment installed under this contract for a continuous period of 14 successive days and simultaneously train the Employer's plant supervisors in the correct operation and maintenance thereof. The Certificate of Completion shall only be issued if all the equipment within a section has passed the 14-day continuous test run and the Employer's plant supervisors have been sufficiently trained to continue with the operation of the plant. A Partial Certificate of completion refers to equipment within a section having passed the 14-day continuous test run and the Employer's plant supervisors have been sufficiently trained to continue with the operation of the plant.

The term "installation and commissioning" of material and equipment shall include the on site handling, on site transport, positioning, erection, connection, anchoring, installation and protection thereof, as well as the successful completion of all the specified tests on completion as defined under PS 5.7.2 and PS 5.7.3 and the successful completion of the commissioning period, including the training of the Employees plant supervisors. The tendered rates shall cover all costs for installation and commissioning by the Contractor, including all cost of consumables, labour, erection gear, testing equipment, attendance, additional site visits and profit. Also refer to the Particular Specifications for each type of equipment.

Section payments against each item in accordance with the progress of the work shall be made on a pro rata basis for up to seventy-five (75) percent of

Employer:		Contractor:	
Witness:		Witness:	



the amount tendered against each item on completion of installation and site testing, but with the 14 day continuous plant test pending.

No other payment for installation and commissioning of materials and equipment shall be considered other than that under the "installation and commissioning" items in the Schedule of Quantities.

#### **PS 5.8.2      Testing**

##### **General**

The Contractor shall be responsible for the completed installation passing any tests specified or required by the relevant Local Authority or ACT. The Employer's Agent shall be entitled to be present at such test and the Contractor shall give the Employer's Agent reasonable notice of the dates of the test. Where test certificates are required in terms of any clause of the Specifications or ACT, such certificates shall be submitted to the Employer's Agent immediately after the relevant test have been completed and before the tested equipment is delivered, installed or commissioned as the case may be.

Before handing over the plant the Contractor must carry out tests as specified in detail in the various Sections. The entire cost of testing, including supply of test equipment must be borne by the Contractor and an adequate allowance for such tests must be made in the tendered price. The results of all performance tests shall be fully documented and copies in triplicate submitted to the Employer's Agent prior to final acceptance of the equipment.

The Completion Date will be taken as the date on which the relevant portion of the plant as a complete unit is commissioned or when all the performance tests, have been completed to the satisfaction of the Employer's Agent, whichever date is the later. Johannesburg Water will accept the plant in question on the completion date as herein defined.

##### **Factory Acceptance Testing (FAT)**

The Contractor shall carry out tests in accordance with the requirements of the recognised SANS, IEC or BS standards. Comprehensive details of the standards used and to which equipment applicable shall be supplied. Such additional tests in the manufacturer's "Works", which in the opinion of the

Employer:		Contractor:	
Witness:		Witness:	



Employer's Agent are necessary to determine that the Contract work complies with the requirements of the Specification, whether under test conditions or in normal service, may be called for at no additional cost to the Employer.

The Employer and the Employer's Agent will not inspect any plant, equipment, etc. that is meant to be incorporated into the temporary or permanent Works, that is manufactured, assembled, etc. outside of the province of Gauteng. The Contractor shall make the necessary arrangements for said plant, equipment, etc. to be delivered to a suitable location within the boundaries of Gauteng, at the Contractor's cost, for inspection by the Employer/Employer's Agent. Should the plant, equipment, etc. fail the FAT, the Contractor shall make the necessary arrangements for the plant, equipment, etc. to be rectified, at the Contractor's cost, which may include transportation back to the place of manufacture, assembling, etc.

### **Tests on Site**

All Site tests shall normally be carried out in the presence of, but always to the satisfaction of the Employer's Agent and at such times as he may reasonably require. The Contractor shall provide all the relevant test equipment and bear the costs of all testing to be done. All equipment must be tested to ascertain whether it performs its intended duties in a manner as specified.

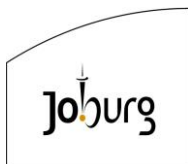
### **Accepted Laboratories**

Unless otherwise stated in a specification that forms part of this Contract, only the testing laboratories of the South African Bureau of Standards, the Council of Scientific and Industrial Research, the relevant Government Departments and Local Authorities shall be accepted as approved laboratories in which tests or design work required in terms of a specification may be carried out.

### **Methods of Testing**

Unless otherwise prescribed in a specification that forms part of this Contract, all testing shall be carried out and interpreted in strict accordance with the methods specified in relevant SANS, IE or BS Specification(s).

Employer:		Contractor:	
Witness:		Witness:	



### **PS 5.8.3 Servicing**

Without limiting in any way, the obligations or responsibilities of the Contractor for maintenance, the Contractor shall make regular quarterly visits to the plant during the maintenance period to supervise the maintenance of the plant. During these visits, he shall make all adjustments and do everything necessary to ensure the proper running of the plant. After each supervising visit to the Site, the Contractor shall submit to the Employer's Agent a report on: -

- (a) The condition of the equipment and the servicing work carried out, and
- (b) Any adjustments which may have been made.

The last servicing visit shall be carried out during the last week of the maintenance period during which visit the Contractor's representative shall carry out full checks on the equipment to ensure that the alignment, clearances and any other setting are correct and he shall carry out any adjustments necessary. The maintenance period shall not terminate until the Employer's Agent is satisfied that the Contractor has finally checked the adjusted equipment.

Servicing shall be measured as scheduled by the number of visits.

The tendered rate shall exclude the cost of providing lubricants but shall cover the cost of servicing visits and operation as specified above.

### **PS 5.9 Format of Communications**

All communication shall be in writing. The format of all communication shall be as approved by JW. The address shall be as stated in the Contract data.

### **PS 5.10 Key Personnel**

Tenderers shall state, in the format of a schedule, the posts for which he shall consider key personnel for the Site of Works. The number of such key personnel occupying the Site shall not be required at the tender stage. The Contractor once formally requested, by the Employer's Agent, shall make available the contact details of all the key personnel on site.

Employer:		Contractor:	
Witness:		Witness:	



The Contractor shall not withdraw from the Site of the Works any of his erection and installation staff until such time as the plant has been completely erected and installed, except with the written consent of the Employer's Agent.

**PS 5.11 Management Meetings**

The Contractor shall be required to attend separate monthly management progress meetings. Minutes shall be kept by the Employer's Agent who shall distribute such minutes to the Employer and the Contractor. The Contractor must include for attending technical meetings as and when required by the Employer's Agent (generally also on a monthly basis, but on alternate fortnights to the management meetings, i.e. one management meeting and one technical meeting per month).

**PS 5.12 Forms for Contract Administration & Reporting**

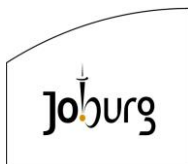
The Employer shall provide all standard forms for the administration of the contract. The Contractor shall be required to correspond on the standardized format.

The Contractor shall comply with all the Employer's reporting requirements which includes but is not limited to progress reporting, financial reporting, Local labour reporting, etc. The frequency of reporting will generally be on a monthly basis.

**PS 5.13 Daily Records**

The Contractor shall be required to keep a daily on Site record activity report. The activity report shall be submitted to the Employer's Agent's Representative for signature on a daily basis. Daily records shall include all on site activities and progress made shall be kept by the Contractor. These records shall include all material deliveries for the day, personnel employed on the Site of Works, equipment delivered to site or storage and the number of man-hours for the week in question. Plant used during the on-site activities shall need to be recorded by the Contractor.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 5.14 Payment Certificates**

Monthly payment certificates shall be submitted by the Contractor in the format approved by the Employer's Agent.

Payment for particular items scheduled shall conform to the payment clauses of the Project Specifications and that of the Particular Specifications.

The tendered rates or sums shall cover the cost of drawings and instructions for anything not specially mentioned but obviously required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material required for the proper installation of such equipment in complete working order), to enable the equipment as described to be installed and/or function safely and correctly as specified.

No claims whatever for extras shall be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned in the Schedule of Quantities.

Payment for "supply and delivery", "install and commission", "servicing" and "tools and spares" is respectively defined in PS 3.2, PS 5.7, and PS 6.7.

Before becoming entitled to any of the above payments, the Contractor shall lodge with the Employer's Agent three copies of a detailed invoice showing the amount claimed as well as a claim form in triplicate complete by item as scheduled in a format approved by the Employer's Agent.

Payment Certificates shall be delivered to The Employer's Agent by the 20<sup>th</sup> of each month.

#### **PS 5.15 Permits**

Whatever import, transport, equipment certification permits etc are necessary for the completion of the Works to be carried out under this contract shall be the Contractor's responsibility to obtain.

Employer:		Contractor:	
Witness:		Witness:	



## PS 5.16 Recording of Weather and Abnormal Rainfall

No extension of time for completion will be granted on account of normal inclement weather, but extension of time shall be determined for abnormal rainfall or wet conditions in accordance with the formulae given below, separately for each calendar month or part thereof. It shall be calculated for the full period for completion of the Contract plus any granted extension thereof:

$$V = (Nw - Nn) R_w/R_n \text{ ..... if } (Nw - Nn) > 0$$

The symbols shall have the following meanings respectively:

- $V$  = Extension of time in calendar days in respect of the calendar month under consideration.
- $Nw$  = Actual number of days during the calendar month on which a rainfall of 10 mm or more is recorded.
- $Nn$  = Average number of days, as derived from existing rainfall records, on which a rainfall of 10 mm or more has been recorded for the calendar month.
- $R_w$  = Actual rainfall in mm recorded for the calendar month.
- $R_n$  = Average rainfall in mm for the calendar month under consideration as determined from existing rainfall records.

When calculating extension of time for a part of a month pro rata values of  $R_n$  and  $Nn$  shall be used.

The factor  $R_w/R_n$  shall be deemed to be a fair allowance for days on which wet conditions disrupted or prevented work, but on which a rainfall of 10 mm or more was not recorded. If the value of  $R_w/R_n$  exceeds 2,5 it shall be taken as 2,5.

If  $Nw$  for any month is smaller than  $Nn$ , the formula used shall be

$$V1 = (Nn - Nw)$$

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
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The total extension of time for completion shall be the sum of the values of V, minus the sum of the values of V1.

$$\text{Total extension of time} = \sum V - \sum V1$$

The following are the most reliable values of Nn and Rn available and shall be used unless other values are mutually agreed upon beforehand:

<b>MONTH</b>	<b>Nn</b>	<b>Rn</b>	<b>MONTH</b>	<b>Nn</b>	<b>Rn</b>
January	3.7	108.9	July	0.3	8.4
February	3.1	96.6	August	0.3	7.6
March	2.4	78.6	September	0.6	20.1
April	1.5	46.1	October	1.9	62.4
May	0.7	21.7	November	3.6	104.5
June	0.2	7.1	December	3.7	109.1
<b>AVERAGE YEARLY RAINFALL</b>				<b>22</b>	<b>671.1</b>

Source of information: Weather Bureau, Department of Transport, Pretoria, for Zuurbekom, Klipspruit and Syferfontein.

Accurate rain gauging shall be done at the offices of the Resident Engineer. This data will be regarded as the actual recorded rainfall for the Contract. The readings will be done by the Resident Engineer and the Contractor may attend when rainfall is being gauged.

Any extension of time determined in accordance with the above requirements shall be granted in terms of Clause 5.12 of the General Conditions of Contract, specifically Clause 5.12.2.2: Abnormal climatic conditions.

The Contractor shall allow in his rates and prices for all the effects of adverse weather conditions. In this regard the Contractor should note that all vehicles are susceptible to mobility difficulties in certain parts of the site except that which is prepared to receive traffic.

Employer:		Contractor:	
Witness:		Witness:	



## **PS 6 FEATURES REQUIRING SPECIAL ATTENTION**

### **PS 6.1 General Conditions of Contract (GCC)**

Although the Contract comprises work which includes that of a mechanical, electrical and control and instrumentation nature, the Contract Document is compiled in accordance with the General Conditions of Contract for Construction Works, Second Edition (2015) and Tenderers are therefore required to price the Tender accordingly.

### **PS 6.2 Security**

Though the security of the Bushkoppie Works is outsourced by JW to a security company, the Contractor shall make his own arrangements to secure the on-site facilities provided for the execution of the Contract. The Contractor's required security arrangements shall cover all his works, materials, plant and equipment and personnel.

### **PS 6.3 Schedule of Quantities for Mechanical, Electrical & C&I Work**

The schedules for the electrical, control and instrumentation works differentiate between the supply and delivery of equipment and the installation and commissioning thereof so as to avoid delays in payment after equipment has been supplied and to improve the Contractor's cash flow. The installation and commissioning items shall therefore not be paid for under materials on site.

It is an explicit requirement of the Contract that specialist contractors are approached for the electrical, control and instrumentation works.

### **PS 6.4 Additional Meetings**

The costs of all additional meetings or inspections over and above the normal, that take place because of the Contractor not keeping to his program or because of the quality of his work shall be for the account of the Contractor and shall be deducted from the following payment certificate. An amount of R 5 000.00 per meeting shall be paid by the Contractor to compensate for the travelling cost, time, etc. of both the Employer's Agent and the Employer.

Employer:		Contractor:	
Witness:		Witness:	



## PS 6.5 Certificate of Completion

The Certificate of Completion shall be issued after the successful commissioning of all equipment as described in PS 5.7. The twelve months defects liability period shall start on the date stated in the Certificate of Completion.

Guarantees shall be reduced or returned to the Contractor after issuing of the Certificate of Completion and retention monies shall be paid out after the defects liability period has elapsed. The Certificate of Completion shall not be issued until the documents required in terms of this Contract have been lodged with and accepted as satisfactory by the Employer's Agent.

The issuing of the Certificate of Completion could be delayed if the equipment supplied under this contract cannot be commissioned. If the issuing of the Certificate of Completion is delayed for reasons beyond the Contractor's control, the Contractor shall be compensated for his expenses because of the time delay between the completion of the works and the commissioning of the equipment. The rate tendered for the payment item for the postponement of the issuing of the Certificate of Completion must include for all the Contractor's expenses.

### Measurement and Payment

Unit

Compulsory postponement of the  
issuing of the Certificate of Completion

.....Rate/day

## PS 6.6 Foreign Exchange Risks

The provision of forward cover against foreign exchange fluctuations on the imported content of all equipment required under the contract might be required. In his Tender, the Tenderer must state the value of the imported content of each item and the applicable currencies and the exchange rates on which his tender was based.

Employer:		Contractor:	
Witness:		Witness:	



The successful Tenderer might be required to take out forward cover on all foreign exchange transactions required in his tender for this contract, the rate applied shall be that ruling at the date of commencement of the Contract when that is stated in the Letter of Acceptance.

Amounts tendered shall be adjusted for foreign exchange variations up to the date for commencement of the Contract; any fluctuations after this date shall be for the Contractor's account.

#### **PS 6.7 Tools and Spares**

As part of the equipment supplied, the Contractor shall supply all special tools or keys required for adjustment to any parts of such equipment.

The Contractor shall supply such spares ordered by the Employer's Agent.

The cost of special tools and keys shall be covered by the tendered rate or price for the Supply Items of the relevant equipment.

Payment for spares and standard spanners and cabinet(s) shall be made out of the Prime Cost Sum allowed in the Schedule of Quantities for such items. The Contractor's profit, administration and delivery charges shall be paid at the tendered percentage of the actual purchase price of the goods.

#### **PS 6.8 Operational Manual**

The Contractor must compile and provide three copies of a complete operation manual for the equipment provided. This manual shall contain comprehensive information as set out hereafter.

- (a) Drawings of the equipment detailing all part numbers and materials.
- (b) A complete spares list.
- (c) A lubrication and maintenance schedule showing all maintenance and lubrication operations, their recommended frequency and the grades of lubricant required.
- (d) A maintenance brochure describing all maintenance, adjustment and replacement procedures.

Employer:		Contractor:	
Witness:		Witness:	



- (e) Operating manual describing the operation of the equipment with performance curves where applicable.
- (f) A manual detailing all dismantling and reassembly procedures.
- (g) Maintenance procedure for corrosion protection painting systems.
- (h) Complete Data book of the equipment on completion of the Contract.

The Contractor shall amplify and amend such drafts until the Employer's Agent is satisfied that they shall fulfil the purpose of ensuring that the Employer's staff is adequately instructed to operate and maintain the works. Once the drafts have been accepted by the Employer's Agent, the Contractor shall prepare three suitably bound copies and deliver them to the Employer's Agent.

The Contractor shall also provide a simplified version of the O&M Manual, to the satisfaction of the Employer's Agent, for daily use by the treatment works operational staff.

The manuals shall be drawn up in English.

In addition to the above, the Contractor, and where necessary the suppliers of equipment, shall be required to instruct the works personnel in the proper and correct operation of the equipment installed for a maximum period of 1 day (per piece of equipment). The timing of this training shall be determined in consultation with the Employer and the Employer's Agent.

### **Mechanical, Electrical, and C&I Requirements for as built drawings**

All duly signed As Built Drawings are to be submitted in a transparent plastic format as supplied by REGMA or similar.

Transparent plastic specification for 914 mm x 45 m rolls.

Type: Hydromat 08.

Transparencies may be submitted in size A1 provided they are legible. It is permissible to submit transparencies in size A0 if that is the size of the original. Electronic copies of all duly signed drawings are to be submitted in Auto CAD and/or Revit 3D format.

Employer:		Contractor:	
Witness:		Witness:	



In addition to the above a bound volume in A3 paper prints of all Electrical drawings are to be supplied.

**PS 6.9 General**

**PS 6.9.1 Abbreviations**

Wherever abbreviations for published national Standard Specifications or named Standard Specifications are used, they shall be deemed to refer to the latest edition of the Specification concerned, including all amendments, published 30 days before the closing date for receipt of tenders. Typical abbreviations are:-

ASTM : American Society for Testing Materials  
BS : British Standard  
BSCP : British Standard Code of Practice  
SANS : South African National Standards  
SIS : Standards Institute Sweden  
IEC : International Electrotechnical Commission

**PS 6.9.2 Metric Symbols**

Symbols prescribed by the System Internationale (SI) are used in these Specifications.

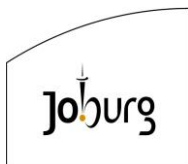
**PS 6.9.3 Definitions**

OHS ACT : Occupational Health and Safety Act, 1993 (Act 85 of 1993), as amended and including any regulations made thereunder.

**PS 6.9.4 SANS Standard**

All materials used and the standards of workmanship employed for the execution of the Works shall comply with the appropriate SANS Standard and or Code and if they do not carry the SANS mark, the Contractor shall obtain a certificate from SANS stating that the items comply with the appropriate SANS standard.

Employer:		Contractor:	
Witness:		Witness:	



## **PS 6.10 Conditional Assessment Reports prepared by Contractor**

The Contractor will be required, as and when, to undertake conditional assessments of existing infrastructure (civil, mechanical, electrical and instrumentation), to assess their suitability for refurbishment, or otherwise. The results of these conditional assessments and inspections undertaken by the Contractor must be documented in a detailed Conditional Assessment Report that addresses, amongst others, the methodology that was used to undertake the assessment, an informed assessment of the condition of the equipment that was inspected, recommendations regarding possible refurbishment/replacement options, equipment supplier recommendations (where feasible), proposed timeframes for replacement or refurbishment, risks and guarantees associated with refurbishment, and indicative costs. The Conditional Assessment Report must provide sufficient detail to enable the Employer to make an informed decision regarding the best course of action regarding that particular piece of infrastructure or equipment.

The Conditional Assessment Report will only be accepted as complete by the Employer, once any comments or queries that have been raised by the Employer and the Employer's Agent have been adequately addressed. The Employer retains sole discretion as to whether the recommendations in the Conditional Assessment Report can be accepted and/or implemented.

## **PS 6.11 Installation of Equipment**

### **PS 6.11.1 Safety**

The Contractor shall at all times observe proper and adequate safety precautions on the Site. Where adequate, safety precautions are not being observed, the Employer's Agent may order the Contractor to comply with minimum safety requirements at the Contractor's expense and compliance with such an order shall not absolve the Contractor from any of his responsibilities and obligations under the Contract and the Occupational Health and Safety Act.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 6.11.2 General**

A skilled erector shall be in charge of the work at all times and any instructions and explanations which the Employer's Agent shall give to him, shall be deemed to have given the Contractor.

The work shall be neat and workmanlike true to line and level, plumb and in proper working order.

Where any item of plant is mounted on a frame or bed plate, packers of 10 mm minimum thickness machined to size shall be provided and fitted by the Contractor to ensure accurate alignment.

Where required to correct alignment, all mounted units shall be shimmed with non-corrosive metal shims. Shims shall be the shape and size as the contact area of the parts and slotted so that the shims can be removed without removing the mounted bolts.

All cut edges shall be without burrs. Shims with wrinkles in the material shall not be permitted.

Only small lugs shall protrude after completion.

All equipment shall be properly assembled and mounted to avoid the setting up of initial stresses in the materials and to ensure perfectly free running of all moving parts.

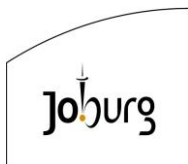
#### **PS 6.12 Operation of Valves**

The Contractor may not operate any valves, sluice gates or any other equipment currently in use on the works without permission from the Works Manager.

#### **PS 6.13 Work Outside Normal Working Hours**

Should the Contractor wish to work outside normal working hours (Monday to Friday 07h00-17h00) he is to obtain permission from the Employer's Agent. This permission shall not be unreasonably withheld.

Employer:		Contractor:	
Witness:		Witness:	



#### **PS 6.14 Community Liaison and Community Relations**

See Clause 1.4 of the Environmental Management Plan forming part of this document.

The Contractor shall in consultation with the local Ward Councillor employ a full time Community Liaison Officer (CLO) and/or Labour Desk Officer (LDO) for the duration of the contract.

#### **PS 6.15 Employment of Local Labour**

The Contractor shall make every effort to employ staff from the local communities within the Johannesburg Metropolitan Area. Skilled workers may only be brought in from outside the local communities if such personnel are not available locally. The Contractor shall pursue a programme of recruitment and training of persons from the local communities, through either the CLO and/or LDO. The Contractor shall carry out a training programme for the duration of the construction process for local staff employed or to be employed by him on the site. Apart from satisfying the immediate requirements for unskilled labour, the development of the proficiency of these staff in semi-skilled and skilled categories such as carpenters, steelfixers, shutter hands, drivers, clerks etc. is required. The minimum total number of man days of work provided to the community, local to the construction site, shall be 45 000 for the contract.

The contractor must report on local labour employment as well as SMME employment in the required format on a monthly basis. This information must accompany monthly Payment Certificates, and if not provided, Payment Certificates will not be processed for payment.

#### **RATES OF COMPENSATION**

The Contractor's attention is drawn to Clause 1.4(d) of the Environmental Management Plan (Volume 2) regarding the preferential employment from local communities of labourers and where available skilled artisans.

The Contractor's shall pay Local Labour rates in accordance with the following:

Employer:		Contractor:	
Witness:		Witness:	



GOVERNMENT GAZETTE, 17 December 2021, No. 45645. DEPARTMENT OF EMPLOYMENT AND LABOUR NO. R. 1605, LABOUR RELATIONS ACT, 1995, BARGAINING COUNCIL FOR THE CIVIL ENGINEERING INDUSTRY (BCCEI): RENEWAL OF PERIOD OF OPERATION OF THE WAGE AND TASK GRADE COLLECTIVE AGREEMENT (**OR SIMILAR BARGAINING COUNCIL THAT MAY BE RELEVANT TO THE SCOPE OF WORKS**, FOR E.G. THE METAL AND ENGINEERING INDUSTRIES BARGAINING COUNCIL, OR THE NATIONAL BARGAINING COUNCIL FOR THE ELECTRICAL INDUSTRY SA, etc.)

and any subsequent update to the relevant Collective Bargaining Agreement, that may be gazetted by the Department of Employment and Labour or Bargaining Council during the execution of this Contract.

It is expressly noted that the rates contained in the aforementioned Gazette or Collective Bargaining Agreement will apply to the Contractor or subcontractor(s) irrespective of whether the Contractor or subcontractor(s) is a member of the employer's organisations listed in the Bargaining Council, or not. It is equally noted that the rates contained in the aforementioned Gazette or Collective Bargaining Agreement will apply to all employees employed for the purposes of executing the Contract (and specifically those defined as local labour) irrespective of whether those employees are members of the trade unions listed in the gazette, or not.

In the absence of a relevant Collective Bargaining Agreement, the labour rates as stipulated by the City of Johannesburg shall apply.

The Contractor shall not be permitted to terminate any Contract of Employment for any individual employed as "Local Labour" during the period beginning in November (in any given year) until the end of January of the subsequent year.

## **PS 7 HEALTH AND SAFETY SPECIFICATIONS FOR CONSTRUCTION WORK**

Tendering Contractors are to prepare Health and Safety Plans in accordance with Johannesburg Water's Health and Safety Specification (refer to Volume 2: Occupational

Employer:		Contractor:	
Witness:		Witness:	



Health and Safety Specification and Environmental Management Plan for Capital Investment Projects). The legal imperatives for this requirement stem from the Construction Regulations (2014), and more specifically the following:

- Regulation 5(1)(b): A client must prepare a suitable, sufficiently documented and coherent site specific health and safety specification for the intended construction work based on the baseline risk assessment
- Regulation 5(1)(f): A client must include the health and safety specification in the tender documents;
- Regulation 5(1)(i): A client must discuss and negotiate with the principal contractor the contents of the principal contractor's health and safety plan contemplated in regulation 7(1), and must thereafter finally approve that plan for implementation;
- Regulation 5(1)(m): A client must ensure that a copy of the principal contractor's health and safety plan is available on request to an employee, inspector or contractor;
- Regulation 5(1)(n): take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained;
- Regulation 7(1)(a): A principal contractor must provide and demonstrate to the client a suitable, sufficiently documented and coherent site specific health and safety plan, based on the client's documented health and safety specifications, which must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses;
- Regulation 7(1)(b): A principal contractor must open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, which must be made available on request to an inspector, the client, the client's agent or a contractor;

#### **PS 7.1 Project-related Occupational Health and Safety**

According to the Construction Regulations (2014), a Health and Safety Plan “means a site, activity or project specific documented plan in accordance with

Employer:		Contractor:	
Witness:		Witness:	

the client's health and safety specification". Apart from complying with the Health and Safety Specification (Volume 2), specific attention is drawn to the identification and assessment of risks. The tendering Contractors are required to consider inter alia the following risks (where applicable):

Project- and site-specific risks:

- Excavation and safeguarding of trenches;
- Working in confined spaces;
- Working next to roads;
- Traffic control;
- Plant and machinery operation;
- Existing services;
- Offloading of material;
- Overhead power lines;
- Hand tools;
- Laying of pipes;
- Laying of cable trays and cables;
- Machine operator;
- Third party exposures;
- Use of portable electrical tools;
- Location of site camp;
- Levelling of materials;
- Storage and handling of material;
- Storage of hazardous materials;
- Fire prevention and protection;
- Fuel supply;
- Refuelling vehicles/plant;
- Welding;
- Gas welding and cutting operations;
- Handling of compressed gas cylinders;
- Handling of asbestos;
- Aggregate/Sand Delivery;
- Form and Support work;
- Landscaping;
- Lifting equipment;
- Loading/unloading supervision;
- Material delivery;
- Material handling;
- Installing cable mounting poles;
- Gas explosions;
- Excavator;
- Drivers – of vehicles;
- Electrical Distribution boards;
- Demolitions;
- Corrosive liquids;

Employer:		Contractor:	
Witness:		Witness:	

- Other contractors;
- Hand drills;
- Pedestal Drills;
- Bench grinders;
- Pedestal Grinders;
- Placing concrete;
- Portable ladders;
- Scaffolding;
- Site Establishment;
- Working on elevated positions;
- Working close to existing services i.e. electrical, water, etc;
- Working close to water and on bridges;
- Working with pressure vessels under pressure;
- Workshops;

## PS 7.2 Guide to risk assessments

### PS 7.2.1 Nine Steps to Effective Risk Assessments

- |        |   |
|--------|---|
| Step 1 | Identifying the current as well as emerging hazard, risks or exposures.   |
| Step 2 | Aim to identify major hazards, don't waste time on the minor and detail except if such hazard has the potential be repeat itself on a frequent basis. |
| Step 3 | Involve as many people as possible in the ongoing risk assessment process especially those at risk.   |
| Step 4 | Gather all the information and analyze it.  |
| Step 5 | Look at what actually could or has occurred including non-routine operations.   |
| Step 6 | Use a systematic approach to ensure all hazards are adequately addressed.   |
| Step 7 | Assess the risks identified or the risk has occurred by taking into account the effectiveness of current as well as controls under consideration.     |
| Step 8 | Ensure the process is practical, realistic, cost and business effective.  |
| Step 9 | Always record the assessment in writing including i.e. assumptions, date and why a particular decision has been made.                                 |

Employer:		Contractor:	
Witness:		Witness:	

PS 7.2.2 How serious is it?

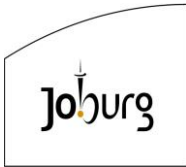
Probability		Consequences
A	Common	1 Fatality or permanent disability.
B	Has Happened	2 Major injury.
C	Could Happen	3 Average Lost Time Injury.
D	Not Likely	4 Minor Injury.
E	Practically impossible	5 Medical Treatment or less.

		Probability				
		A	B	C	D	E
Consequence	1	1	2	3	4	5
	2	2	3	4	5	6
	3	3	4	5	6	7
	4	4	5	6	7	8
	5	5	6	7	8	9
Risk rating		Action				
1 - 3 =		Serious Immediate (within 1 week).				
4 - 5 =		High Within 1 month.				
6 - 7 =		Moderate > 4 weeks.				
8 - 9 =		Acceptable No action but will consider from time to time.				

**PS 8 HEALTH AND SAFETY SPECIFICATION FOR CONSTRUCTION WORK**

Tendering Contractors are to adhere to the mitigation measures listed in the Environmental Management Plan (EMP) (refer to Volume 3: Occupational Health and Safety Specification and Environmental Management Plan as well as Environmental Management Programme). **Environmental** mitigation

Employer:		Contractor:	
Witness:		Witness:	



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measures are actions needed to align a project implementation phase with environmental control principles, where potential impacts to the natural and social environment are prevented, minimised or remediated. Environmental safeguarding is governed by various sets of legislation, with the most noteworthy for this project constituting the National Environmental Management Act (No. 107 of 1998) and the National Water Act (No. 36 of 1998).

Employer:		Contractor:	
Witness:		Witness:	



## **PORTION 2: PARTICULARS OF REQUIRED CIVIL WORKS**

### **SANS 1200A: CIVIL ENGINEERING CONSTRUCTION: PRELIMINARY AND GENERAL**

This portion of the specification covers variations and additions to the SANS 1200 Standardised Specifications. The clause numbers hereunder consist of a prefix, such as "PSA" indicating an amendment to SANS 1200 A and a number that represents the number of the clause in SANS 1200.

#### **PSA 3 MATERIALS**

##### **PSA 3.3 Materials Supplied by Others**

Where materials are supplied by others, the Contractor shall take delivery of such materials on site and shall be responsible for the safekeeping of the same from the time of taking delivery to the time of building into the Works or the time of return to the supplier. The Contractor shall return to the supplier any materials not used on the Contract.

##### **PSA 3.4 Name Boards**

The numbers of name boards noted in the Bill of Quantities are to be provided under this contract.

No other name boards other than stated above shall be allowed. The Contractor shall erect the name boards at locations indicated by the while establishing himself on Site, but not later than 14 days after the start of the Contract.

The name boards shall comply with the requirements as stipulated by the Employer's Agent.

On completion of the works, the Contractor shall obliterate all particulars on the name board and remove the board from the site, prior to the release of retention money.

Employer:		Contractor:	
Witness:		Witness:	



## **PSA 3.5 Site Office**

Replace this Sub-Clause with the following:

### **PSA 3.5.1 Specification for Office & Meeting Room Furniture**

In addition to the furniture supplied by the Employer, the following items shall be provided under this Contract:

- a. One (1) office desk each with a surface area of at least 1.5m<sup>2</sup> with lockable drawers with keys.
- b. One (1) drawing rack for A0 drawings. The hangers shall be of the “Barhold” type with ten hangers per drawing rack.
- c. One (1) drawing table with an inclined surface area of at least 3m<sup>2</sup> and a smooth top constructed to the dimensions as directed by the Employer’s Agent’s Representative.
- d. Two (2) sturdy and comfortable chairs fitted with padded seats and backrests.
- e. Venetian blinds or roller blinds, opaque type fitted to all the Employer’s Agent’s offices.
- f. One (1) large meeting table to accommodate approximately 15 people.
- g. Fifteen (15) plastic chairs with metal frames; and
- h. One (1) plastic rubbish bin.
- i. Laptop with the following minimum specifications: Core I7-1135G7 processor, 8 Gig DDR4 RAM, 500GB SSD hard drive, 19.5 inch external monitor, security cable, carry case, mouse and Windows 10 operating system, Microsoft Office Business Suite 2019 and 20 Gigs of Data.

Employer:		Contractor:	
Witness:		Witness:	



- j. Software – One (1) Microsoft Office Business Suite 2010 (Word, Excel, Outlook, Powerpoint), One (1) Autocad 2021, One (1) Civil 3d 2021, three (3) MS Project 2010 and Four (4) Voloview (drawing viewer).

#### **PSA 3.5.2 Employer's Agent's Meeting Room and Employer's Office**

The Contractor shall provide one prefabricated site meeting room and one office similar to the existing meeting room and offices of approved dimensions with at least 35m<sup>2</sup> in floor area for the meeting room and 18m<sup>2</sup> in floor area for the Employer's Office. The rooms shall be completed, furnished and ready for use not later than three weeks after the commencement date of the Contract.

The timber floor of the office shall be at least 300mm above the surrounding ground level. Doors shall be provided at each end of the meeting room and each shall be provided with a suitable 3 lever lock and two keys.

Windows shall be provided, with a minimum glazed area of 15% of the floor area. At least half of this area must be able to open and shall be fitted with burglar bars and all the windows shall be fitted with venetian or other approved blinds.

The meeting room will be equipped with furniture supplied under PSAB 3.2.1.

Two (2) air conditioning units shall be supplied with the meeting room with capacity for the air volume of the room as per PSAB 3.2.6 and one (1) air conditioning unit shall be supplied for the Employer's Office.

Adequate electric fluorescent lighting and four (4) 15-amp power points.

#### **PSA 3.5.3 Car Ports**

Carports shall be so constructed as to protect the vehicles parked under them at all times against rain, hail and sun. Shade netting will not be permitted for the carports. Preference is for corrugated iron sheeting for the roof and sides. The carports shall each be at least 15 m<sup>2</sup> in area and their floors shall consist

Employer:		Contractor:	
Witness:		Witness:	



of a layer of broken stone or concrete to minimise dusty and muddy conditions.  
Seven car ports are required.

#### **PSA 3.5.4 Areas Surrounding Offices**

The access and other roads and parking areas surrounding the existing offices shall be treated and maintained to make them dust free either by using crushed stone or bituminous surfacing. They shall be well drained and kept trafficable and free from mud and weeds at all times. They shall also be maintained and kept clean and tidy at all times.

#### **PSA 3.5.5 Air-conditioning Units and Heaters**

The Contractor shall provide and install air-conditioning units and heaters in all offices and meeting rooms. The air-conditioning units shall be electrically operated compressor type with closed circuit, and not an evaporation type. The capacity of the air-conditioning units shall be at least 2,2 kW. The heaters shall preferably be of the space-heating type without exposed elements and shall have a capacity of not less than 1,5 kW.

#### **PSA 3.5.6 Ablution units**

Ablution facilities for the sole use of the Employer's Agent's staff and visitors must be provided.

#### **PSA 3.6 Services**

##### **PSA 3.6.1 Sanitary arrangements**

The Contractor shall be responsible for providing all sanitary services on the site.

The Contractor shall also make provision for the removal of all domestic rubbish on a regular basis.

##### **PSA 3.6.2 Water and Electricity**

Employer:		Contractor:	
Witness:		Witness:	



The Contractor shall provide a constant supply of clean potable water suitable for human consumption.

The cost of all water & electricity required for the Employer's Agent's purposes shall be borne by the Contractor. All buildings supplied shall include the provision of 220 V electricity.

### **PSA 3.6.3 Maintenance**

The Contractor shall provide all labour, equipment and material which may be necessary to keep all accommodation in a neat and clean condition, and repairs shall be done without undue delay.

### **PSA 3.7 General**

- a. The Contractor shall not order any materials, equipment or fittings on the basis of their having been specified or scheduled without the written confirmation of the Employer's Agent having been obtained. No building shall be erected without the Employer's Agent's written instructions as to the exact position and orientation of the building.
- b. Unless otherwise agreed upon, the meeting room shall be erected in close proximity to the Employer's Agent's offices.
- c. The required facilities shall be completed, ready for occupation as specified, not later than three (3) weeks after the Commencement Date of the contract.
- d. The ownership of the meeting room and Employer's Office shall remain the property of the Employer at the end of the Contract.
- e. The ownership of the furniture in PSAB 3.2.1 and PSAB 3.2.3 shall remain the property of the Employer.

Employer:		Contractor:	
Witness:		Witness:	



- f. The Contractor shall take all reasonable precautions to prevent unauthorised entry to the offices and to ensure the general security of the offices and meeting rooms.
- g. No accommodation shall be erected without the prior approval of the Drawings by all local or Government authorities requiring such prior approval.

**PSA 4 PLANT**

**PSA 4.2 Contractor's Offices, Stores and Services**

Add the following:

The Contractor shall make the necessary arrangements with the relevant authority for the provision of services such as telephone and water for domestic and/or construction purposes.

The electrical wiring of all buildings shall be carried out by registered and licensed electricians in accordance with the requirements of SANS 0142 and the regulations of the local authority.

The Contractor shall not be obliged to make use of local water and electricity services and shall be at liberty to obtain them from approved alternative sources.

Should the Contractor make use of local services, he shall make arrangements, where applicable, for connections to be made, complete with meters, from these services for use at the Site. All costs incurred in respect of these connections and the meters, pipes, cables, etc. from the connections to his facilities, the cost of the water consumed, the cost of the removal of sewage (not chemical toilets), and the cost for finally disconnecting and removing the services shall be paid by the Contractor, who shall include full compensation for such costs in his tendered rates for the various items of work requiring the use of one or more of the services. The Contractor shall furnish the Employer's Agent with documentary proof that proper notice has been given to the relevant authority for termination of the services.

Employer:		Contractor:	
Witness:		Witness:	



The Contractor's camp shall be kept neat and clean at all times and all surplus or rejected material shall be removed from site immediately.

The Contractor under this Contract shall supply his own distribution board for distributing the power to his facilities. He shall be responsible for distribution of power and water supply to other mechanical and electrical Contractors on the Site. Payment for these services to other Contractors shall be arranged between the Contractor under this Contract and the other Contractors. The Employer will not be involved in any arrangements in this regard.

The Contractor shall deliver to the Employer's Agent a detailed drawing of the proposed layout of his offices, stores and services before erecting same.

Sufficient backup services shall be provided to ensure the uninterrupted execution of the Works such as storage tanks for water for use in the mixing of concrete, standby electrical power for work at night and/ power interruptions, and for electrical plant and equipment used on Site.

#### **PSA 4.3 Plant and Equipment**

Add the following to this sub-clause:

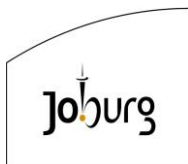
The Contractor is required to provide all plant and materials necessary to carry out the works as required. No additional allowances other than those already specified in the Bill of Quantities shall be allowed for with respect to plant and materials.

Add the following to this sub-clause:

The Contractor is required to provide all equipment necessary to carry out the works as required. No additional allowances other than those already specified in the Bill of Quantities shall be allowed for with respect to equipment.

Construction equipment shall be suited for the onsite intended use and shall comply with all relevant safety aspects required by the OHS Act.

Employer:		Contractor:	
Witness:		Witness:	



**PSA 5 CONSTRUCTION**

**PSA 5.1 Survey**

**PSA 5.1.1 Setting Out of The Works**

Delete this sub-clause and replace with the following:

The Contractor shall set out the works and maintain their correct position, not only according to the Contract Documents but also according to any drawings or orders that he may receive from time to time from the Employer's Agent. The Contractor shall:

- a. be held responsible for the accuracy of the setting out for the full period of the Contract.
- b. use equipment and instruments that can ensure the necessary accuracy.
- c. be held responsible for the correction of any error at his own expense and
- d. update the plans, which are kept on site so that all the changes approved by the Employer's Agent are reflected on the drawings. These drawings will represent record drawings and must consequently reflect the Works as they are actually built. The cost for this shall be deemed to have been included in all works construction rates. The Contractor must check drawings periodically and after completion of the Contract they shall be handed over to the Employer's Agent.
- e. confirm the levels and coordinates of all benchmarks prior to commencing with construction.

Add the following to this sub-clause:

**PSA 5.1.3 Alterations, Additions, Extensions and Modifications to Existing Works**

Employer:		Contractor:	
Witness:		Witness:	



The Contractor is required to verify the accuracy of all drawings and levels provided by the Employer's Agent prior to commencing with any construction activities.

Where the Works require that alterations, additions, extensions and / or modifications be carried out to existing works or facilities, these shall be carried out strictly in accordance with the requirements of the relevant authorities.

## **PSA 5.2 Watching, Barricading, Lighting and Traffic Crossings**

Replace the words "traffic crossings" in the heading and in text of this sub-clause with the words "accommodation of traffic"

Add the following:

### **PSA 5.2.1 General Accommodation of Traffic**

The Contractor shall be responsible for the safe and easy passage of vehicular and pedestrian traffic over, past or alongside the works.

### **PSA 5.2.2 Traffic control**

Wherever the Contractor's activities on site affect or have the potential to affect the normal flow or safety of traffic during the construction, he shall be responsible for all aspects of traffic control, including flagmen, warning devices, signs, channelisation devices, layout of detours and by-passes, sign sequences and layouts, and all the requirements of the Chief Traffic Officer of the Local Authority.

Only warning devices, signs and channelisation devices included in the latest Road Traffic Ordinance of the province concerned (hereinafter referred to in this clause as the "Ordinance") shall be used. The standard patterns of the traffic control devices and signs, and the traffic-control procedures and methods prescribed in the Ordinance shall be applied. The dimensions and other properties of all signs and devices and the sign and device sequences, layouts and spacing shall be in accordance with the provisions of the Ordinance

Employer:		Contractor:	
Witness:		Witness:	



unless otherwise specified. In addition, signs and devices shall be placed at the positions shown on the Drawings. In cases not covered by the Ordinance, the signs, speed limits, devices, sequences, layouts and spacing shall comply with the requirements of The South African Road Traffic Signs Manual, the Chief Traffic Officer of the relevant authority, and the Employer's Agent.

The Contractor shall ensure the safe accommodation of traffic at all areas where the Works may impact on traffic, and shall provide all drums, watching, lighting, signs and barricades required by the road authorities, and in accordance with the South African Road Traffic Signs Manual. In this regard, the following references have been extracted from the SARTSM Volume 2, Chapter 13:

Item	Page No.
General	13.10.1
Urban Roadworks	13.10.1
Temporary Traffic Signals	13.10.2
Sidewalk Deviation	13.10.4
Localised Work Site – Good Visibility	13.10.6
Lane Closed Beyond a Junction	13.10.8
Work within a Junction	13.10.10
Work in a One-way Street	13.10.12
Road Closure - CBD	13.10.14
Road Closure – Dual Carriageway Street	13.10.16
Road Closure - Detour	13.10.18

Employer:		Contractor:	
Witness:		Witness:	



Freeway/Dual Carriageway: Lane Closure

13.11.3

Where applicable, the Contractor shall be responsible for traffic-control at night and adequate warning lights and flashing lights shall be provided.

**PSA 5.3 Protection of Structures**

Add the following:

**PSA 5.3.1 Inspection of Adjoining Properties**

The Contractor shall carry out inspections and evidence collection, as he deems appropriate, of properties adjoining the works to ensure that, in the event of a claim arising from any of the owners of the adjoining properties for damage to property and the like, the Contractor has substantial evidence to support or refute such claims. The Contractor accepts full liability and responsibility for damage that he causes to adjoining properties as well as any costs involved in refuting or processing of such claims.

**PSA 5.4 Protection of Overhead and Underground Services**

Add the following:

Timely written notice shall be given by the Contractor to the Employer's Agent and to the authority or department concerned of the Contractor's intention to work across or near any existing works or services and such work shall not commence until the necessary permission has been received. The Contractor will not be entitled to claim for any delay in the construction programme caused by compliance with the requirements of this clause. Work across or near any existing works or services shall be carried out in compliance with the requirements of the relevant authority or department.

Whilst every effort will be made to ensure that any information relating to underground services is correct, the Employer and Employer's Agent takes no responsibility for the accuracy, or for the completeness of the information. The Contractor will be held responsible for any damage to services and shall be

Employer:		Contractor:	
Witness:		Witness:	



liable for the cost of making good the damage. All such costs incurred by the Employer will be deducted from monies due to the Contractor.

Manhole covers; valve boxes, hydrants, etc. shall not be covered over and shall be accessible at all times.

After an existing service has been passed in laying the service pipe, but before backfilling has been started, the Employer's Agent or relevant authority shall be informed in order that they may certify in writing that the service has not been damaged.

Add the following:

#### **PSA 5.4.1 Permits and Way leaves**

The Contractor will be required to obtain permits from all the applicable service providers within the jurisdiction of the City of Johannesburg. It is the Contractors responsibility to obtain final permit approval according to applicable procedures and specifications. Permits and associated costs shall be deemed to have been included in the schedule rates for Way leaves and Permits.

Add the following:

#### **PSA 5.4.2 Responsibilities**

##### **The Contractor:**

- a. Shall make provision for the possible existence of numerous services (e.g.: Stormwater, Water, Sewers, Eskom, City Power, Egoli Gas, Sasol Gas, Rand Water, Telkom, and the like) within and in close proximity to the work areas.
- b. Shall obtain way leaves indicating the location of existing services from all affected service providers prior to the commencement of

Employer:		Contractor:	
Witness:		Witness:	



construction. The Contractor is to comply with the conditions of the way leaves received from the various service providers.

- c. Shall ensure the protection and integrity of all existing services exposed and encountered through the course of construction activities. Adequacy in terms of protection of existing services shall be at the discretion of the Employer's Agent. The Contractor is to make good the protection of and any breakages to existing services. The Contractor is to record on the As-Built drawings the location of existing services or services which have been relocated during the Contract Period.
- d. Shall inform the relevant service provider immediately (within 2 hours of the incident) such that procedures for the reinstatement of the service can be effected, should he damage or break an existing service (whether known or unknown).
- e. Is responsible to provide their own equipment in order to determine the location of existing services.

Add the following:

### **PSA 5.4.3 Locating Existing Services**

Existing known services, both underground and overhead, are indicated on the drawings, but the positions of existing services on the drawings are not guaranteed nor does the Employer, nor the Employer's Agent, accept any liability in this regard. The Contractor shall liaise with all relevant local authorities to satisfy himself that all relevant services have been located.

At the commencement of the Contract, the Contractor shall hand excavate a distance 0.5 m on each side of the located service to expose it. The exposed service shall be identified and recorded on a drawing.

A copy of the drawing with all known services shall be submitted to the Employer's Agent before construction can commence in any road reserve.

Employer:		Contractor:	
Witness:		Witness:	



Once the exposed service is identified and recorded the excavation shall immediately be backfilled. Re-excavation by hand at construction stage will not be measured in addition to normal trench excavation.

The Contractor shall retain full responsibility for establishing the exact positions of the various services in advance of any construction work. No allowance for delays or disruption shall be entertained unless the Contractor complies fully with the provisions of this clause regarding the establishment of the exact positions of the various services in advance of any construction work

#### **PSA 5.5      Dealing with Water**

Add the following paragraph:

"The Contractor shall be deemed to have acquainted himself during tender stage with the groundwater and surface water conditions."

#### **PSA 5.6      Pollution**

Add the following:

##### **Precaution against Pollution and Nuisance**

The Contractor's attention is drawn to the fact that operations will be conducted in urban areas and in the presence of passing traffic. The Contractor shall take all necessary steps and precautions to prevent pollution of the surrounding area by his employees in any way.

Wherever excavated and/or loaded material is liable to form a dust nuisance, an effective method of spraying water over the cut area and loaded material shall be installed. Tarpaulins shall be provided to cover trucks and prevent dust blowing from loads during transport.

Any material or debris falling from trucks on the roads in use by the public shall be immediately removed. Precautions shall be taken to prevent fouling of public roads or completed construction by trucks transporting muddy material.

Employer:		Contractor:	
Witness:		Witness:	



The Employer's Agent may order the Contractor to continuously broom off and clean where the mud tracking of vehicle or falling debris may constitute a danger to the public making use of roads.

## **PSA 5.7 SAFETY**

Add the following:

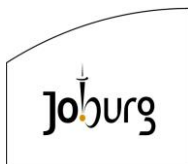
1. The Contractor shall at all times observe adequate safety precautions on Site to ensure the safety of his own staff as well as that of the public and other persons engaged in or about the Works. In this respect he shall observe all laws, ordinances and regulations pertaining to his work.
2. The Contractor's attention is specifically drawn to the following Acts, and particularly to the relevant regulations under each Act, copies of which shall at all times be kept by him on the Site:
  - The Factories, Machinery and Building Work Act (Act 22 of 1941)
  - The Explosives Act (Act 26 of 1956)
  - The Mines and Works Act (Act 27 of 1956)
  - The Occupational Health and Safety Act (Act 85 of 1993)
3. The Contractor is also required to comply with the safety precautions set out in the following publications, copies of which shall also be kept by him on the Site:
  - The Code of Practice relating to the safety of men working in civil Engineering inspection pits and small diameter vertical shafts. (Transactions of the South African Institution of Civil Engineers, Vol. 2, No. 11, November 1960, obtainable from the Secretary, S.A. Institution of Civil Engineers, Private Bag X200, Halfway House, 1685).

Employer:		Contractor:	
Witness:		Witness:	



- The Operator's Handbook on Sewage Purification (1965) Chapter 26. Safety Precautions published by the Institute of Water Pollution Control (Southern African Branch).
- 4. The Contractor shall provide suitable and safe access by way of ladders, gangways, etc. to all parts of the Works as may be required for construction purposes or for inspection by the Employer's Agent or the authorised Inspectors in terms of the above-mentioned Acts.
- 5. All precautions shall be taken to protect workmen against falling material and/or objects and other dangers whilst they are carrying out their duties. Shaft and trenches shall in every way be made and kept safe for persons working therein.
- 6. All persons working, inspecting or supervising in places where falling material and/or objects could be encountered shall be provided by the Contractor with hard hats of a type approved by the Inspector of Mines, the use of which shall be strictly enforced.
- 7. The Contractor shall provide a properly equipped first aid box, which shall be accessible at all times.
- 8. Where adequate safety precautions are not being observed, the Employer's Agent may order the Contractor to comply with minimum safety requirements at the latter's expense. Compliance with such order will not absolve the Contractor from any of his responsibilities and obligations under the Contract.
- 9. The Contractor shall display on a prominent place the following emergency information:
  - **Local Police:** Telephone number
  - **Local Ambulance:** Telephone number
  - **Local Fire Brigade:** Telephone number

Employer:		Contractor:	
Witness:		Witness:	



- **Nearest Doctor:**      Name
- Telephone number (office hours)
- Telephone number (after hours)
- Consulting room street address

## **PSA 8            MEASUREMENT AND PAYMENT**

### **PSA 8.1.2.3    Contractor to Price all Items**

Add the following paragraph;

"The grouping of payment items under one all-inclusive rate is prohibited. Each payment item shall have its own rate. Where the Contractor elects not to insert a rate for any particular item, then it shall be deemed to be zero".

## **PSA 8.2            Payment**

### **PSA 8.2.2        Time-related Items**

In the event that the net total extension of time granted in terms of the Contract and/or delay in the anticipated date of award of the Contract results in the official date for completion extending into or past a Christmas Builders Holiday period which did not fall within the tendered period for completion based on the anticipated date of award, and extension of time equivalent to the number of normal working days falling within that holiday period shall reduce to 25% of that applicable in terms of the above. It should be noted that time-related charges for the Christmas Builders Holiday period falling within the tendered period for completions based on the anticipated date of award of the Contract will be paid for at the full rate since such holidays are to be included in the tendered period for completion.

Employer:		Contractor:	
Witness:		Witness:	



The anticipated date of award referred to above shall be the date stated in the Contract Documents. If the date is not stated it shall be considered to be any date within the period of validity of the Tender.

Delete the last four lines of this sub-clause, i.e. the paragraph commencing with the word "Note..."

### **PSA 8.3 Scheduled Fixed-Charged and Value-Related Items**

#### **PSA 8.3.1 Contractual Requirements**

Add the following to this clause:

As indicated in the Contract Data (Clause 8.6.13), any claims against the insurance effected by the Employer shall be subject to the Contractor being responsible for the payment of the amount stated in the Policy as being the Deductible (First Amount Payable) as defined in the Policy.

#### **PSA 8.3.2.1 Facilities for Employer's Agent**

Add the following to this sub-clause:

- |    |   |                  |
|----|---|------------------|
| d) | Latrine facilities                                      | <b>Unit: Sum</b> |
| e) | Board room to accommodate 15 personnel                  | <b>Unit: Sum</b> |
| f) | Carports (5 of)   | <b>Unit: No</b>  |
| h) | Construction & setting out of survey beacons (3 No. of) | <b>Unit: Sum</b> |
| i) | Furniture for offices & meeting room                    | <b>Unit: Sum</b> |
| j) | Laptop, Data & Software                                 | <b>Unit: Sum</b> |

#### **PSA 8.3.2.2 Facilities for the Contractor**

- (f) Tools and Equipment

Employer:		Contractor:	
Witness:		Witness:	



Add the following new sub-clause:

“The sum shall cover the cost of supplying all hand tools and equipment, as necessary for proper execution of the works.

**Unit: Sum**

Add the following new sub-clause:

(k) Security of works

“The sum shall cover the cost of supplying 24hr security at the Contractors camp as well as all other areas of the Works for the duration of the Contract. The cost should also include all other security requirements, as deemed necessary by the Contractor. Refer to clause PS7.2.

**Unit: Sum**

Add the following new sub-clause:

(l) Personal Protection Equipment

“The sum shall cover the cost of supplying all personal protective equipment, as deemed necessary by the Contractor and in accordance with the Health & Safety Plan.

**Unit: Sum**

#### **PSA 8.4 Scheduled Time Related Items**

##### **PSA 8.4.2.1 Facilities for Employer’s Agent**

Add the following to this sub-clause:

e) Latrine facilities for the sole of the Employer’s Agent

**Unit: Sum**

f) Boardroom to accommodate 15 personnel

**Unit: Sum**

g) Carports (5 No. of)

**Unit: No**

h) Construction & setting out of survey beacons (3 No. of)

**Unit: Sum**

Employer:		Contractor:	
Witness:		Witness:	



i) Furniture for offices and meeting rooms **Unit: Sum**

j) Laptop, Data & Software **Unit: Sum**

#### **PSA 8.4.2.2 Facilities for the Contractor**

Add the following new sub-clause:

k) Security of Works

"The sum shall cover the cost of supplying all security works, as deemed necessary by the Contractor, refer to clause PS7.1 **Unit: Sum**

l) Water Tanker for Dust Suppression

The rate shall include for the full-time supply and operation of a water tanker, with assistant to keep all the roads and work areas dust free for the duration of the contract. The rate shall include for the filling of the tanker from a designated water source. **Unit: Sum**

#### **PSA 8.4.3 Supervision for the Duration of the Contract**

Add the following to the Clause:

The sum stated shall include, at minimum, the cost of full time, on-site supervision in the form of a Site Agent and Contracts Manager; whose qualifications and level of experience meet the requirements stated in the Functionality Criteria (Volume 1, Part 1, Tender Procedures). Both resources will be expected to provide the full range of Project Management Services as they relate to the Works. **Unit: Sum**

#### **PSA 8.4.4 Compliance with Local Content Requirements**

The sum stated shall include, at minimum, the cost of all items required to ensure compliance with local content obligations. These may include (but are not limited to), packaging of works, sourcing, evaluation and negotiations, appointments, contracts, liaison with Ward councillor,

Employer:		Contractor:	
Witness:		Witness:	



CLO, LDO, and JW Stakeholder Relations, etc. Additionally, the sum stated should include any additional items that the Contractor may deem necessary. **Unit: Sum**

#### **PSA 8.5 Sums Stated Provisionally by Employer's Agent**

Add the following sub-items:

a) Provisional sum for control testing to be carried out as required by the Employer's Agent, including testing of structure **Unit: Prov Sum**

b) Additional tests ordered by Employer's Agent **Unit: Prov Sum**

The provisional sum shall cover the cost of control tests specifically ordered by the Employer's Agent. Tests shall be executed by an approved commercial laboratory.

c) Community Liaison Officer **Unit: Prov Sum**

The provisional sum shall cover the cost of advertising, interviewing and employing the CLO. Additionally, it should include the CLO's salary for the duration of the Contract.

d) Training of targeted labour and SMME's

The sum shall be in full compensation for the provision of training to targeted labour according to the specification of the Employer and approved by the Employer's Agent. **Unit: Prov Sum**

e) Training of Interns

The sum shall be in full compensation for the provision of training of interns according to the specification of the Employer and approved by the Employer's Agent. **Unit: Prov Sum**

f) Signage for Buildings

The sum shall cover the full cost of the supply and installation of signage onsite. **Unit: Prov Sum**

Employer:		Contractor:	
Witness:		Witness:	



g) GPR Survey

The sum shall cover the full cost of a GPR survey to identify all existing sub-surface services as directed by the Employer's Agent. The survey submission must include all drawings in DWG and PDF format. **Unit: Prov Sum**

h) Protection of Existing Services

The sum shall cover the full cost of protecting the identified existing services which may be exposed during the duration of the Contract. **Unit: Prov Sum**

i) Application for Environmental regulation

The sum shall cover the full cost for Environmental Regulation which may be required by the authorities during the duration of the Contract. **Unit: Prov Sum**

j) Environmental Control Officer

The sum shall cover the full cost of an Environmental Control Officer during the duration of the Contract. **Unit: Prov Sum**

k) Full time Environmental Liaison Officer

The sum shall cover the full cost of a Full time Environmental Liaison Officer during the duration of the Contract. **Unit: Prov Sum**

l) Project Mentor

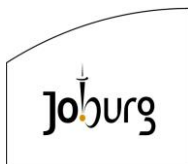
The sum shall cover the full cost of a Project Mentor during the duration of the Contract. **Unit: Prov Sum**

m) Contractor's percentage to cover cost of handling cost and charges

Contractor's percentage to cover cost of handling cost and charges for items (a) to (l) **Unit: Percentage**

**PSA 8.7 Daywork**

Employer:		Contractor:	
Witness:		Witness:	



Replace this clause with the following:

**PSA 8.7.1 Expenditure on Daywork Items**

Wages paid to workmen and invoices of cost of materials delivered on site.

**Unit: Prov Sum**

**PSA 8.7.2 Supervision, Overheads and All Other Costs**

Extra over item PSA 8.7.1 for supervision, overheads and all other costs related to the Daywork items under item PSA 8.7.1 for the following:

- |    |                     |                                     |
|----|---------------------|-------------------------------------|
| a) | Skilled Labourers   | <b>Unit: Percentage of Prov Sum</b> |
| b) | Unskilled Labourers | <b>Unit: Percentage of Prov Sum</b> |
| c) | Material            | <b>Unit: Percentage of Prov Sum</b> |

**PSA 8.7.3 Plant Hire Rates**

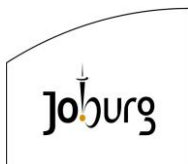
Types and sizes indicated in the bill of quantities **Unit: hours**

- a) Labour

The labour charges to be reimbursed under the Daywork item PSA 8.7.1 in the Schedule of Quantities shall be the actual amount of wages paid to workmen, chargehands and gangers, (but not foremen), employed on Daywork with the authorisation of the Employer's Agent. The labour charges will be paid only for the time that the workmen are actually employed on Daywork.

Leave pay, bonuses, subsistence allowances, employer's contributions to medical schemes and provident funds and the like shall not be included in the above-mentioned labour charges but will be deemed to be covered by the percentage rate tendered by the Contractor against the items PSA 8.7.2(a) and

Employer:		Contractor:	
Witness:		Witness:	



PSA 8.7.2(b) scheduled for this purpose under Daywork in the Schedule of Quantities.

This percentage rate shall also be deemed to allow for the use of small tools, supervision, insurances, overhead expenses, transport of workmen, housing and feeding (if the liability of the Contractor) profit and any other expenses in connection with workmen employed on Daywork and shall also include for everything else covered under the allowances as stated in Clause 6.5 of the GCC.

b) Materials

The material charges to be reimbursed under the Daywork item PSA 8.7.1 scheduled in the Schedule of Quantities shall be the invoiced cost as approved by the Employer's Agent, less any discount granted by the Supplier. Only the actual quantities of materials used, as verified by the Employer's Agent, will be paid for.

The cost of transportation to site, storage, transportation to the point of use on site, insurance, superintendence and administrative costs, overhead expenses and profit shall be deemed to be covered by the percentage rate tendered by the Contractor against the item PSA 8.7.2(c) scheduled for this purpose under Daywork in the Schedule of Quantities. The percentage rate tendered shall also include for everything else covered under the allowances as stated in Clause 6.5 of the GCC.

c) Plant Hire Rates

The rates tendered for the hire of plant shall be applicable only to plant that the Contractor has on the site and shall be total all inclusive unit prices which shall include, inter alia, for all fuel and lubricants; for the wages of operators, drivers or attendants; for all tools, accessories, equipment and everything else necessary; for all depreciation, maintenance and repair costs; for overhead expenses, profit and for everything in accordance with Clause 6.5 of the GCC.

Employer:		Contractor:	
Witness:		Witness:	



The hire charges shall be paid only for the time that the plant is actually working on the Daywork as authorised by the Employer's Agent.

Payment will not be made in respect of established, fixed or static plant on the site such as static concrete batching and mixing plant, cocopan track, monorails, static generators, compressors, pumps, lighting, ventilation plant and the like which are covered under other items but which may be used for Daywork.

## **PSA 8.8 Temporary Work**

### **PSA 8.8.4 Relocation of Services**

Excavation for exposing existing services in the following depth ranges below ground level:

a. 0,0 m up to 2,0 m:

- |                           |  |
|---------------------------|--|
| i. Soft material          | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| ii. Intermediate material | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| iii. Hard material        | <b>Unit: cubic metre (m<sup>3</sup>)</b> |

b. Exceeding 2,0 m up to 4,0 m:

- |                           |  |
|---------------------------|--|
| i. Soft material          | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| ii. Intermediate material | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| iii. Hard material        | <b>Unit: cubic metre (m<sup>3</sup>)</b> |

- c. Extra over sub-items (a) and (b) above for hand excavation by means of hand tools such as picks, crowbars and pneumatic tools in close vicinity of services or where no blasting or machine excavation is allowed:

Employer:		Contractor:	
Witness:		Witness:	



- |      |                       |  |
|------|-----------------------|--|
| i.   | Soft material         | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| ii.  | Intermediate material | <b>Unit: cubic metre (m<sup>3</sup>)</b> |
| iii. | Hard material         | <b>Unit: cubic metre (m<sup>3</sup>)</b> |

The unit of measurement shall be in cubic metre of the material removed as specified.

The rates shall include full compensation for all cost to excavate and break down the various classes of materials, including the cost of all the necessary additional effort, plant, tools, materials, labour and supervision.

#### **PSA 8.9 Work Stoppage**

The rate tendered shall cover all unforeseen work stoppages which may be attributed to community disruptions, COVID-19 related delays etc, and will be assessed at the discretion of the Employer's Agent. Rate to be based on the Contractors total Time Related Preliminary & General items. **Unit: Days**

#### **PSA 8.10 Sub-Contractors (SMME's)**

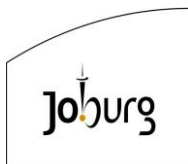
##### **PSA 8.10.1 Main Contractor Overhead Charges and Profits**

The Main Contractor shall retain liability and responsibility for the management, scheduling, and quality control of all works performed by approved sub-contractors (SMME's). This item will be calculated as a percentage of the sum of works allocated to SMME's and shall include the process to appoint a sub-contractor, as well as all costs and charges to manage all sub-contracted works. (Note: This amount must be at a minimum as stated of the total contract value). **Unit: Percentage of total amount of work done by SMME's (%)**

##### **PSA 8.10.2 Fixed Charge Items for SMME Contractual Requirements**

This item will be calculated as a percentage of the approved amount towards Fixed Charged Preliminary and General Items allocated to SMME's as compensation for Overhead Charges and Profits for the Main Contractor.

Employer:		Contractor:	
Witness:		Witness:	



**Unit: Percentage of total amount of Fixed Charge Items for SMME's (%)**

**PSA 8.10.3 Time Related Items for SMME Contractual Requirements**

This item will be calculated as a percentage of the approved amount towards Time Related Preliminary and General Items allocated to SMME's as compensation for Overhead Charges and Profits for the Main Contractor.

**Unit: Percentage of total amount of Time Related Charges for SMME's (%)**

**PSA 8.10.4 Payments on behalf of Sub-Contractor by Main Contractor**

Provisional Sum to cover costs incurred by the Contractor when making payments on behalf of the sub-contractor (ref Special Conditions) or to provide ad-hoc services on behalf of the sub-contractor.

**Unit: Prov. Sum**

**SANS 1200AB: EMPLOYER'S AGENT'S OFFICE**

**PSAB 1 SCOPE**

Replace this Clause with the following:

This section covers the provision of accommodation for the Employer's Agent's resident staff. This accommodation shall include the necessary additional offices and furniture as well as the provision of all the services required. The Contractor will be required to supply a meeting room, an Employers office, a Employer's Agent's Representative's Office and five car ports.

All furniture supplied shall be new.

**PSAB 3 MATERIALS**

**PSAB 3.1 Name Boards**

The numbers of name boards noted in the Bill of Quantities are to be provided under this contract.

No other name boards other than stated above shall be allowed. The Contractor shall erect the name boards at locations indicated by the while

Employer:		Contractor:	
Witness:		Witness:	



establishing himself on Site, but not later than 14 days after the start of the Contract.

The name boards shall comply with the requirements as stipulated by the Employer's Agent.

On completion of the works, the Contractor shall obliterate all particulars on the name board and remove the board from the site, prior to the release of retention money.

## **PSAB 3.2 Site Office**

Replace this Sub-Clause with the following:

### **PSAB 3.2.1 Specification for Office & Meeting Room Furniture**

In addition to the furniture supplied by the Employer, the following items shall be provided under this Contract:

- k. One (1) office desk each with a surface area of at least 1.5m<sup>2</sup> with lockable drawers with keys.
- l. One (1) drawing rack for A0 drawings. The hangers shall be of the "Barhold" type with ten hangers per drawing rack.
- m. One (1) drawing table with an inclined surface area of at least 3m<sup>2</sup> and a smooth top constructed to the dimensions as directed by the Employer's Agent's Representative.
- n. Two (2) sturdy and comfortable chairs fitted with padded seats and backrests.
- o. Venetian blinds or roller blinds, opaque type fitted to all the Employer's Agent's offices.

Employer:		Contractor:	
Witness:		Witness:	



- p. One (1) large meeting table to accommodate approximately 15 people.
- q. Fifteen (15) plastic chairs with metal frames; and
- r. One (1) plastic rubbish bin.

### **PSAB 3.2.2 Employer's Agent's Meeting Room and Employer's Office**

The Contractor shall provide one prefabricated site meeting room and one office similar to the existing meeting room and offices of approved dimensions with at least 35m<sup>2</sup> in floor area for the meeting room and 18m<sup>2</sup> in floor area for the Employer's Office. The rooms shall be completed, furnished and ready for use not later than three weeks after the commencement date of the Contract.

The timber floor of the office shall be at least 300mm above the surrounding ground level. Doors shall be provided at each end of the meeting room and each shall be provided with a suitable 3 lever lock and two keys.

Windows shall be provided, with a minimum glazed area of 15% of the floor area. At least half of this area must be able to open and shall be fitted with burglar bars and all the windows shall be fitted with venetian or other approved blinds.

The meeting room will be equipped with furniture supplied under PSAB 3.2.1.

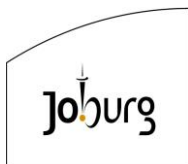
Two (2) air conditioning units shall be supplied with the meeting room with capacity for the air volume of the room as per PSAB 3.2.6 and one (1) air conditioning unit shall be supplied for the Employer's Office.

Adequate electric fluorescent lighting and four (4) 15-amp power points.

### **PSAB 3.2.4 Car Ports**

Carports shall be so constructed as to protect the vehicles parked under them at all times against rain, hail and sun. Shade netting will not be permitted for

Employer:		Contractor:	
Witness:		Witness:	



the carports. Preference is for corrugated iron sheeting for the roof and sides. The carports shall each be at least 15 m<sup>2</sup> in area and their floors shall consist of a layer of broken stone or concrete to minimise dusty and muddy conditions. Seven car ports are required.

#### **PSAB 3.2.5 Areas Surrounding Offices**

The access and other roads and parking areas surrounding the existing offices shall be treated and maintained to make them dust free either by using crushed stone or bituminous surfacing. They shall be well drained and kept trafficable and free from mud and weeds at all times. They shall also be maintained and kept clean and tidy at all times.

#### **PSAB 3.2.6 Air-conditioning Units and Heaters**

The Contractor shall provide and install air-conditioning units and heaters as specified. The air-conditioning units shall be electrically operated compressor type with closed circuit, and not an evaporation type. The capacity of the air-conditioning units shall be at least 2,2 kW. The heaters shall preferably be of the space-heating type without exposed elements and shall have a capacity of not less than 1,5 kW.

#### **PSAB 3.2.7 Ablution units**

Ablution facilities for the sole use of the Employer's Agent's staff and visitors must be provided.

### **PSAB 3.3 Services**

#### **PSAB 3.3.1 Sanitary arrangements**

The Contractor shall be responsible for providing all sanitary services on the site.

The Contractor shall also make provision for the removal of all domestic rubbish on a regular basis.

Employer:		Contractor:	
Witness:		Witness:	



### **PSAB 3.3.2 Water and Electricity**

The Contractor shall provide a constant supply of clean potable water suitable for human consumption.

The cost of all water & electricity required for the Employer's Agent's purposes shall be borne by the Contractor. All buildings supplied shall include the provision of 220 V electricity.

### **PSAB 3.3.3 Maintenance**

The Contractor shall provide all labour, equipment and material which may be necessary to keep all accommodation in a neat and clean condition, and repairs shall be done without undue delay.

### **PSAB 3.4 General**

- h. The Contractor shall not order any materials, equipment or fittings on the basis of their having been specified or scheduled without the written confirmation of the Employer's Agent having been obtained. No building shall be erected without the Employer's Agent's written instructions as to the exact position and orientation of the building.
- i. Unless otherwise agreed upon, the meeting room shall be erected in close proximity to the Employer's Agent's offices.
- j. The required facilities shall be completed, ready for occupation as specified, not later than three (3) weeks after the commencement date of the contract.
- k. The ownership of the meeting room and Employer's Office shall remain the property of the Employer at the end of the Contract.
- l. The ownership of the furniture in PSAB 3.2.1 and PSAB 3.2.3 shall remain the property of the Employer.

Employer:		Contractor:	
Witness:		Witness:	



- m. The Contractor shall take all reasonable precautions to prevent unauthorised entry to the offices and to ensure the general security of the offices and meeting rooms.
- n. No accommodation shall be erected without the prior approval of the Drawings by all local or Government authorities requiring such prior approval.

### **PSAB 3.5 Insurance**

The Contractor shall keep all the site offices, furniture and equipment insured against loss, damage or breakage and shall indemnify the Employer, the Employer's Agent and his staff against claims in this regard for the full duration of the Contract.

## **SANS 1200 C: SITE CLEARANCE**

### **PSC 3 MATERIALS**

#### **PSC 3.1 Disposal of Material**

Add the following:

"The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

### **PSC 5 CONSTRUCTION**

#### **PSC 5.1 Areas to be Cleared and Grubbed**

Add the following:

"Pipeline routes shall be cleared on instruction of the Employer's Agent to a distance of 1.5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations."

#### **PSC 5.2 Cutting of Trees**

Employer:		Contractor:	
Witness:		Witness:	



## **Preservation of Trees**

### **PSC 5.2.3.2 Individual Trees**

**Replace the last sentence with the following:**

"An amount of R1 000,00 will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily and without prior instruction from the Employer's Agent."

### **PSC 5.5 Re-clearing of Vegetation**

Add the following:

"When areas have to be re-cleared on the written instructions of the Employer's Agent, such re-clearing shall be carried out at the Contractor's own cost and the Contractor is therefore advised not to clear the areas too soon."

## **SANS 1200 D: EARTHWORKS**

### **PSD 3.2 Classification for Placing Purposes**

#### **PSD 3.2.3 Material Suitable for Backfill or Fill Against Structures**

This clause is deleted and replaced by:

Areas against structures which may be damaged by the use of heavy equipment (e.g. grader, towed grid roller, large self-propelled vibratory roller, etc.) must get filled in layers with material from the excavations on the site which shall comply with clause 3.2.1 except that it shall contain more than 20% material passing the 75 micron sieve.

### **PSD 3.3 Selection**

#### **PSD 3.3.1 General**

Add the following:

Employer:		Contractor:	
Witness:		Witness:	



The Contractor will be required to stockpile the surplus excavated material on sites to be designated on the drawings or by the Employer's Agent.

The Contractor shall be entirely responsible for the selection of suitable material for all backfilling and embankments from excavation on the site and from borrow pits.

**PSD 5 Construction**

**PSD 5.1.1 Safety**

**PSD 5.1.3 Stormwater and Groundwater**

Add the following to this Sub-Clause:

Over and above his general obligations in regard to dealing with water as specified in SANS 1200 A, the Contractor shall be responsible for preventing the ingress of water into the foundation excavations. The preventive measures shall include the construction of proper drainage channels, diversion channels, berms, sumps, and the supply, operation and maintenance of the necessary bailing and pumping equipment if required.

The dewatering measures, with the exception of pumping, shall be maintained until the backfilling has been completed, after which all settled silt, mud, etc. shall be removed from the exposed surfaces where necessary. Between the various construction stages, pumping may be interrupted as may be decided by the Employer's Agent. The draining or pumping of water from foundation excavations shall be so done that no concrete materials will be carried away.

**PSD 5.2.2 Excavation**

Add the following Sub Clauses:

**PSD 5.2.2.4 Utilization of Excavated Material**

Employer:		Contractor:	
Witness:		Witness:	



Excavated material and material recovered from temporary work shall, in so far as it is suitable, be utilized for backfill. Material unsuitable for use as backfill or in excess of the quantity required to complete the backfill shall be spoiled or utilized as directed by the Employer's Agent.

#### **PSD 5.2.2.5 Excavation limits for payment purposes**

For measurement and payment purposes, the limits of the excavations for structures shall be as shown on the Drawings.

Where no excavation limits are shown on the Drawings and the Employer's Agent has decided that formwork has to be provided for the sides of a concrete member, the limits of the excavation for measurement and payment purposes shall be the vertical planes 0.5 m outside the perimeter of the concrete member for which the formwork is to be provided, and the founding level shown on the Drawings.

#### **PSD 5.2.2.6 Unsuitable Material**

Boulders, logs or any other unsuitable excavated material shall be taken to spoil.

Where, in the opinion of the Employer's Agent, unsuitable material is encountered at founding level, such material shall be removed and replaced with foundation fill in accordance with the requirements of clause PSD 5.2.3.4 of this section and as directed by the Employer's Agent.

#### **PSD 5.2.2.7 Preparation of the Founding Surface**

Where hard material suitable for founding is encountered at the founding level, it shall be cut and trimmed to a firm surface, either level, stepped or serrated, as may be required.

Where there are indications that the material at the founding level will be soft material or hard material that will deteriorate rapidly on exposure, the

Employer:		Contractor:	
Witness:		Witness:	



excavation of the final layer with a thickness of 150 mm shall be postponed until just before the blinding layer is placed.

Where shown on the Drawings or ordered by the Employer's Agent, excavations shall be extended to a specified depth below the given undersides of the slabs and footings to make provision for the placing of a concrete blinding layer.

### **PSD 5.2.3.3 Backfill and Fill Near Structures**

#### **a. General**

When placing backfill and fill, the following precautions shall be taken:

- i. In so far as it is possible, the material shall be placed simultaneously to approximately the same elevation on both sides of a structure or structural member where appropriate. If conditions require that backfill or fill be placed appreciably higher on one side than on the opposite side, the additional material on the higher side shall not be placed until authorized by the Employer's Agent and preferably not until the concrete has been in place for 14 days, or until tests show that the concrete has attained sufficient strength to withstand any pressure safely that has been created by the backfill or fill or by the method of construction.
- ii. The material behind structural members restrained at the top by the superstructure, e.g. portal type structures, shall be placed as stated on the Drawings or as directed by the Employer's Agent.

#### **b. Backfill**

Excavated areas around structures, between the structure and the vertical walls of the surrounding excavation, shall be backfilled with approved material in horizontal layers not exceeding 150 mm in depth after compaction, to the level of the original ground surface or to the level specified on the Drawings. Each layer shall be moistened or dried to the optimum moisture content for the

Employer:		Contractor:	
Witness:		Witness:	



material and be compacted to a density of not less than 93 % of modified AASHTO density, except that, in a road prism, the material shall be compacted to a density of not less than 93 % of modified AASHTO density. In cases where structures are founded on backfill material, the density shall be as specified in the Project Specifications but shall not be less than 95 % of modified AASHTO density.

c. Prevention of Wedge Action

Before the fill in the space between a structure and any adjacent sloping fill and the backfill between a structure and the sloping sides of the surrounding excavation is constructed, the slope of the fill and of the sides of the excavation shall be benched or serrated in order to prevent wedge action between the structure and the fill or the sides of the excavation during backfilling and compaction.

The distance between the exposed face of the structure and the toe of the fill or excavation side shall be sufficient to allow proper compaction.

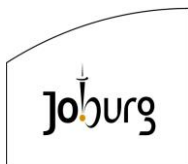
**PSD 5.2.3.4 Foundation fill**

If, during the course of excavation, it is found that the material at the indicated founding depth does not have the required bearing capacity as specified on the Drawings, the excavations shall be extended at the discretion of the Employer's Agent until satisfactory founding material is encountered. The Employer's Agent reserves the right to order the Contractor to make up the difference in levels with foundation fill.

Where the foundation fill consists of rock or crushed stone, it shall be constructed as directed by the Employer's Agent.

Foundation fill consisting of granular material shall be constructed in layers not exceeding 150 mm in thickness after compaction. Each layer shall be moistened or dried to optimum moisture content for the material and be compacted to a density of not less than 95 % of modified AASHTO density.

Employer:		Contractor:	
Witness:		Witness:	



Mass concrete fill to be used shall be of the class or mix specified or directed by the Employer's Agent.

**PSD 5.2.4.2 Topsoiling**

Delete this Sub-Clause and refer to Section PSVA.

**PSD 5.2.4.3 Grass or Other Vegetation**

Delete this Sub-Clause and refer to Section PSVA.

**PSD 8 MEASUREMENT AND PAYMENT**

**PSD 8.3.2 Bulk Excavation**

- b. Extra over for: Delete pay items (3) and (4).

**PSD 8.3.3 Restricted Excavation**

- a. Excavation for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose

Add the following to this pay item

- i. In the case of structures, excavation will be scheduled to different depths as follows:

- a. 0 m up to 2 m **Unit: Cubic metre (m<sup>3</sup>)**
- b. Exceeding 2 m up to 4 m **Unit: Cubic metre (m<sup>3</sup>)**
- c. Etc. in increments of 2 m depths **Unit: Cubic metre (m<sup>3</sup>)**

- (ii) Extra over item (i) above for additional excavation required by the Employer's Agent after the excavation has been completed

**Unit: Cubic metre (m<sup>3</sup>)**

Employer:		Contractor:	
Witness:		Witness:	



The limits for the successive depth ranges shall be measured down from the average surface to the agreed founding level.

The unit of measurement shall be the cubic metre of material measured in the original position before excavation. The quantity of excavation for each depth range shall be calculated from the nett outlines of the excavation limits shown on the Drawings and the depth of excavation completed within each range.

Irrespective of the total depth of the excavation, the quantity of material within each depth range shall be measured and paid for separately.

Where no excavation limits are shown on the Drawings and formwork has to be provided to the sides of concrete members, an additional quantity of excavation shall be measured to 0,5 m outside the concrete perimeter in order to provide a working space.

Where foundation fill is constructed in an excavation, the quantity of excavated material measured for payment shall be the material excavated between the average ground surface, and the founding level, from the prism with vertical sides or as specified or directed by the Employer's Agent.

In no case shall any of the following volumes of excavation be included in the measurement for payment:

- i. The volume of excavation in excess of the abovementioned limits.
- ii. The volume included within the excavated road prism, contiguous channels, ditches, etc. for which payment is provided elsewhere in the Specifications.
- iii. The volume of water or other liquid (except the volume of mud, muck or similar semi solid matter, which has not resulted from the construction operations and which cannot be pumped or drained away).
- iv. Sloping sides of excavations required to make the excavation safe.

Employer:		Contractor:	
Witness:		Witness:	



The tendered rate shall include full compensation for excavation in each class of material, including overbreak in hard material, the spoiling or stockpiling of material, the hauling of excavated material within the defined Site boundaries, for any additional excavation the Contractor may require for additional working space outside the authorized limits, for trimming and cleaning the bottoms and sides of excavation, and for strutting, shoring and safeguarding excavations.

If, after a foundation excavation has been completed, cleaned and trimmed ready for blinding, the Employer's Agent orders further excavations on account of changed dimensions and/or founding conditions, an extra over payment (item PSD 8.3.3(a)(ii) for the additional excavation shall be payable in full compensation for any additional costs to the Contractor over and above the normal excavation costs.

**PSD 8.3.3(b) Extra-over for:**

Delete pay items (3) and (4).

**PSD 8.3.5 Extra Excavation in All Materials to Provide Working Space Around Structures**

Delete this Sub-Clause and refer to Sub-Clause PSD 5.2.2.5.

**PSD 8.3.10 Grassing or other vegetation cover**

Delete this clause and refer to section PSVA.

**SANS 1200 DB: EARTHWORKS (Pipe trenches)**

**PSDB 5 CONSTRUCTION**

**PSDB 4.3 Compaction Equipment**

Add the following to this Sub-Clause:

A minimum thickness of compacted selected fill blanket of 300mm is required over the top of any pipe before machine compaction commences.

Employer:		Contractor:	
Witness:		Witness:	



## **PSDB 5.1      Precautions**

### **PSDB 5.1.1    General**

Add the following to this sub-clause:

The Contractor shall programme his activities in such a way that long sections of trenches do not lie open for undue periods of time, as this poses a safety risk. The pipes shall be laid as soon as possible after excavation of the trenches and the trenches then backfilled. Under no circumstances will trenches be left open for more than 1 week.

The Contractor shall inform the Johannesburg Road Agency (JRA) at least 2 days in advance of the actual date on which he proposes to excavate in any road or footway.

### **PSDB 5.1.3    Accommodation of Traffic and Access to Property**

Add the following Sub-Clause:

All traffic signs and traffic control measures shall comply with the South African Road Traffic Sign Manual and the Road Signs Note.

### **PSDB 5.1.4    Existing Services That Intersect or Adjoin Trenches**

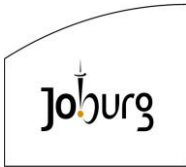
Add the following to this sub-clause:

Where it is necessary for a pipeline to pass under existing services, the Contractor shall carefully excavate and backfill around them. During the course of the work, the services shall be adequately supported to the satisfaction of the Employer's Agent. Any damage shall be reported without delay and shall be made good by the Contractor before backfilling.

## **PSDB 5.4      Excavation**

Add the following to this sub-clause:

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

Volume 2A  
Part 3: Scope of Work



Where the pipe trench crosses surfaced roads the Contractor shall neatly cut four parallel grooves into and through the "black top" before excavating between the inside 2 grooves. The outside 2 grooves should be 100 from the inside ones. The cost of this operation, where not scheduled separately, will be deemed to have been included in the general rates for excavation.

Employer:		Contractor:	
Witness:		Witness:	



## **PSDB 5.5 Trench Bottom**

Add the following to this sub-clause:

Unsuitable material shall only be excavated once the Employer's Agent has given a written instruction to this effect. Backfilling material for over excavation shall comply with the requirements of SANS 1200 LB and shall be compacted to 93 % modified AASHTO.

## **PSDB 5.6 Backfilling**

### **PSDB 5.6.1 General**

Add the following to this sub-clause:

Notwithstanding the requirements of sub-clauses PSDB 5.6.1 and 5.6.6, no pipe joint or pipefitting shall be covered by either the blanket or the backfill prior to the successful completion of the visual inspection and the pressure testing of the relevant section of the pipeline and without the written permission of the Employer's Agent.

### **PSDB 5.6.2 Material for backfilling**

Add the following to this sub-clause:

No backfilling may be done unless it is authorised by the Employer's Agent. Trenches must be backfilled and compacted to 90% modified AASHTO to at least 300mm above the pipe soffit in layers of 150mm around and above the pipe and care should be exercised to prevent damage to the pipe. Subsequent layers may be compacted in 175mm layers. Except where backfill material is in the opinion of the Employer's Agent moist enough; water must be added to facilitate compaction.

In the event of no suitable material being available around the pipe for backfilling the trench in question, the Contractor must obtain suitable material from other excavations, transport it to the site and remove the unsuitable

Employer:		Contractor:	
Witness:		Witness:	



material to an approved dumping site. If no suitable material is thus obtainable, the Contractor must sift the material obtained from the trench through a sieve with a 10mm mesh, but, if above mentioned procedure is not practical, the Employer's Agent may instruct the Contractor to import suitable material from approved sources and the Contractor will be under obligation to remove the unsuitable material to a dumping site.

If any settlement occurs during the Construction Period or before the end of the defect's liability period, the Contractor must rectify such settlement to the satisfaction of the Employer's Agent.

After all the excavations and backfilling have been completed, the surplus material and all additional material must be removed from the site to the satisfaction of the Employer's Agent.

#### **PSDB 5.6.3 Disposal of Soft Excavation Material**

Add the following to this sub-clause:

Surplus material or unsuitable material which is not disposed of within the trench servitude shall, on the instruction of the Employer's Agent, be disposed of at approved tipping sites to be located by the Contractor.

The prior approval of the Employer's Agent must be obtained before surplus material may be deposited, spread and levelled at agreed sites within the area of the works.

#### **PSDB 5.6.4 Disposal of intermediate and hard rock material**

Add the following to this sub-clause:

Surplus intermediate and hard rock material from trench excavations shall, on the instruction of the Employer's Agent, be disposed of at approved tipping sites to be located by the Contractor.

Employer:		Contractor:	
Witness:		Witness:	



The prior approval of the Employer's Agent must be obtained before surplus material may be deposited, spread and levelled at agreed sites within the area of the works.

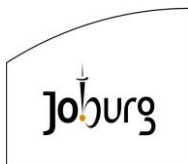
**PSDB 5.7      Compaction**

**PSDB 5.7.2    Areas subject to traffic loads**

Add the following to this sub-clause:

In areas subject to traffic loading and in constructed footways, compaction shall be done as directed by the Employer's Agent.

Employer:		Contractor:	
Witness:		Witness:	



## **PSDB 8 MEASUREMENT AND PAYMENT**

### **PSDB 8.3 Scheduled Items**

#### **PSDB 8.3.5 Existing Services That Intersect or Adjoin A Pipe Trench**

Add the following to the end of the sub-clause:

- v. Notifying and attending upon the proprietor of the service,
- vi. Supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled.

## **SANS 1200 DM : EARTHWORKS (ROADS, SUBGRADE)**

### **PSDM 5.2.2.4 Temporary Stockpiling of Materials**

The Contractor shall programme the Works in such a way that double handling of material is minimised. No additional payment will be made for temporary stockpiling or extra handling where materials must be stockpiled temporarily.

#### **PSDM 5.2.4.3 Topsoiling**

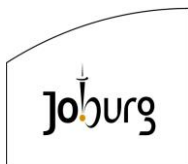
The final thickness of topsoil shall be at least 100 mm.

### **PSDM 7.2 Process Control**

The Contractor shall provide and maintain laboratory equipment on site to perform the following tests or make arrangements to the satisfaction of the Employer's Agent to have them done as and when required:

- a. Indicator Tests.
- b. Sieve Analysis.
- c. Field Compaction Tests.
- d. California Bearing Ratio's (C.B.R.'s)
- e. Mod. AASHTO Density Tests

Employer:		Contractor:	
Witness:		Witness:	



## **SANS 1200 G: CONCRETE (STRUCTURAL)**

### **PSG 3 MATERIALS**

#### **PSG 2.3 Definitions**

##### **PSG 2.3 b) Quality**

Change the following Sub-Clause:

Sample (of concrete). The minimum volume of uncompacted freshly mixed concrete required in terms of SANS Method 861-2 for a designated test (eg 16 dm<sup>3</sup> for the compressive strength test for 3 cubes of nominal side 150 mm).

##### **PSG 2.3 c) Strength**

Change the following Sub-Clause:

Valid test result. The average result obtained from the testing of three test cubes of concrete in accordance with SANS Method 862-1, Method 861-3 and Method 863.

### **PSG 3.2 Cement**

#### **PSG 3.2.1 Applicable Specifications**

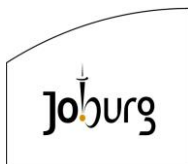
Add the following:

Change this Sub-Clause as follows:

Cementitious materials for concrete shall comply with:

- a. SANS 50197-1-Cement-part 1: Composition, specification and conformity criteria for common cements.
- b. SANS 55167-1: 2011 Part 1-Ground granulated blast-furnace slag.
- c. SANS 55450-1: 2011 Part 2-Fly ash.

Employer:		Contractor:	
Witness:		Witness:	



d. SANS 53263-1: 2011 Silica fume for concrete Part 1.

Under no circumstances shall a “masonry cement” complying with SANS 50413-1 be used for concrete.

Before any concrete is produced, the Contractor shall submit full details of the cement to be used for the production of concrete to the Employer’s Agent for approval. The name of the manufacturer of the cement and the place of manufacture shall also be submitted for approval.

**PSG 3.2.2 Alternative Types of Cement**

Add the following to this Sub-Clause:

The following materials may be used:

CEM II as described in SANS 50197-1.

A site blend comprising, by mass:

70 parts of CEM I.

30 parts of fly ash.

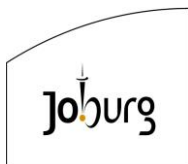
The type of cementitious material to be used for specific structures or structural elements may be specified by the Employer’s Agent.

For concrete pavements and floors that have joints sawn at an early age, the strength class of the cementitious material shall be 42,5N, 42,5R 52,5N or 52,5R.

**PSG 3.2.3 Storage of Cement**

Add the following to this Sub-Clause:

Employer:		Contractor:	
Witness:		Witness:	



Where the cement is supplied in bags, the bags shall be closely and neatly stacked to a height not exceeding 12 bags, and they shall be so arranged that they can be used in the order in which they were delivered to the Site.

Cement shall not be kept in storage for longer than 6 weeks from the date of manufacture without the Employer's Agent's permission.

The Employer's Agent may order the removal of cement, which is older than 6 weeks, from the Site or the alteration of the design mix if he does allow its use. Alternatively, he may allow the cement to be used in concrete of less critical importance, as in blinding layers.

#### **PSG 3.4      Aggregates**

##### **PSG 3.4.3      Storage of Aggregates**

Add the following:

When aggregates of different chloride content are stored on the site, their use in the various classes of concrete shall be strictly controlled."

#### **PSG 3.5      Admixtures**

##### **PSG 3.5.1      Approval of Admixtures Required**

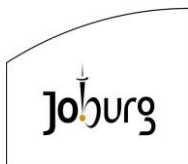
Add the following:

- a. Water proofing additive with tracing agent or similar approved.
- b. Minimum dosage 0,8% by weight of cementitious content, with 20year warranty and all to manufacturers specifications. Concrete to be placed, protected and cured according to SANS 10100-2"

##### **PSG 3.5.3      Specifications:**

Add the following Sub-Clause:

Employer:		Contractor:	
Witness:		Witness:	



Admixtures shall comply with the requirements of ASTM C-494 and full details of the brand and type shall be submitted to the Employer's Agent for approval. Air entraining agents shall comply with the requirements of ASTM C-260 and full details of the brand and type shall be submitted to the Employer's Agent for approval.

**PSG 4 PLANT**

**PSG 4.1 General**

Add the following subclause:

**PSG 4.1.1 Minimum plant**

The Contractor shall have the following minimum plant available and in sound working order:

- a. One concrete mixer of sufficient capacity to complete a section of the floor or road between construction joints within 4 hours and without interruption.
- b. Two concrete vibrators, at least one of which shall be powered by an internal combustion engine.
- c. One air compressor.
- d. Suitable and adequate plant to transport concrete and other material and equipment at all stages of construction.
- e. Storage tanks of adequate capacity to ensure that sufficient water will be available before commencement of every major concrete-placing operation.

If the Plant used for placing concrete is electrically or mechanically powered, the Contractor shall also provide some other approved, non-electrically-powered standby means for placing concrete at an adequate rate in the event of a power or mechanical failure of the main Plant."

Employer:		Contractor:	
Witness:		Witness:	



## **PSG 4.2      Batching Plant**

Add the following Sub-Clause:

- d. admixtures may be batched to an accuracy of within 2 % of the mass required.

## **PSG 4.5      Formwork**

### **PSG 4.5.1      Design**

Add the following:

"All formwork or scaffolding required for any part of the Works shall be designed by the Contractor, and before commencing with the erection of any formwork or scaffolding, the Contractor shall submit the methods he proposes to use to the Employer's Agent for approval. The Employer's Agent has the authority to order alterations to the design or the sizes of any part of the formwork or scaffolding. The Contractor shall check the safety and suitability of all such alterations. The fact that the Employer's Agent has approved or altered any part of the formwork or scaffolding shall not be construed as relieving the Contractor of his responsibility with regard to the strength and stability of the formwork or scaffolding."

### **PSG 4.5.2      Finish**

Add the following to this Sub-Clause:

All external corners shall be chamfered by the fixing of fillet strips into the corners of the formwork to form 20 mm x 20 mm chamfers, all at no extra payment.

### **PSG 4.5.3      Ties**

Add the following:

Employer:		Contractor:	
Witness:		Witness:	



"No plugs, bolts, ties or clamps of any description used to hold the formwork will be allowed to project into or through the concrete unless expressly approved by the Employer's Agent.

Only approved tie-rods consisting of solid rods (that remain embedded in the concrete) and with removable ends shall be used to hold the formwork of the walls. The removable tie-rod ends shall facilitate removal without damage to the concrete, and no permanently embedded parts of such tie-rods shall have less than 50 mm of cover to the finished concrete surface.

The cavities left in the concrete when the tie-rod end cones are removed shall be soundly caulked with a cement mortar to which an approved shrinkage-reducing agent has been added and shall be neatly finished to a smooth surface uniform with that of the surrounding concrete.

The cost of supplying special tie-rods as well as the filling of cavities left by the tie-rod cones shall be included in the rates tendered for formwork under the appropriate pay items.

On no account shall formwork be secured to reinforcing bars."

Only patented ties shall be used on water-retaining structures. Ties must be suitable for grouting to a depth at least equal to the concrete cover or 50 mm. Details of ties to be used shall be submitted to the Employer's Agent for approval.

**PSG 5 CONSTRUCTION**

**PSG 5.1 Reinforcement**

**PSG 5.1.2 Fixing**

Add the following:

Employer:		Contractor:	
Witness:		Witness:	



"The Employer's Agent will inspect the reinforcing after it has been fixed in place, the formwork has been cleaned, cover blocks have been positioned, and before concreting commences.

Welding of reinforcing steel will not be permitted."

### **PSG 5.1.3 Cover**

Add the following:

"The distance between pipes in the concrete and the reinforcing steel shall nowhere be less than

- a. 40 mm or
- b. 5 mm plus the maximum size of the coarse aggregate, whichever is the largest."

The cover of concrete over reinforcement shall be measured from the outside of any reinforcement bar or stirrup. Minimum cover shall be in accordance with the dimension shown on the relevant drawing. Unless otherwise shown on the drawings, minimum cover to reinforcement shall be 50mm.

### **PSG 5.2 Formwork**

#### **PSG 5.2.1 Classification of Finishes**

- a. Smooth

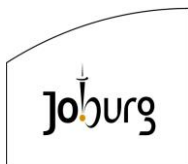
Add the following to this Sub-Clause:

Smooth formwork is required where concrete will be in contact with backfill or where exposed formed surfaces will not readily be visible.

- c. Special

Add the following to this Sub-Clause:

Employer:		Contractor:	
Witness:		Witness:	



Special smooth formwork is required where concrete surfaces are exposed and is to be carried down to 150mm below adjoining ground or paving level.

Imperfections such as small fins, bulges, irregularities, surface honeycombing, and slight surface discolorations shall be made good and repaired by approved methods including rubbing down or grinding to the complete satisfaction of the Employer's Agent. The finish of the concrete shall be accurate to Degree of Accuracy I as defined in terms of Clause 6.

Patching of the tie holes to match the colour of the concrete where exposed.

#### **PSG 5.2.2 Preparation for Formwork**

Add the following:

Surfaces of formwork that are to be in contact with concrete shall be treated with an approved release agent to prevent adhesion of the concrete during stripping. The joints between continuous formwork elements shall be closely butted and, where necessary, if undue leakage is expected, the joints shall be caulked, taped or packed with a sealing gasket, all at no extra payment. Paper, cloth or similar materials shall not be used for this purpose.

Any discolouration to the concrete by the release agent shall be permanently removed.

Construction joints shall be positioned as shown on the Drawings.

#### **PSG 5.2.5 Removal of Formwork**

Add the following subclause:

**PSG 5.2.5.7** The Contractor shall make provision for the continued support of beams and slabs while the formwork is being removed and/or for back propping of beams and slabs.

#### **PSG 5.5 Concrete**

Employer:		Contractor:	
Witness:		Witness:	



## **PSG 5.5.1 Quality**

### **PSG 5.5.1.2 Consistency**

Add the following to this Sub-Clause:

The slump, measured in accordance with SANS Method 862-1, shall be not less than 50 mm and not more than 80 mm, unless permitted otherwise by the Employer's Agent for specific applications.

### **PSG 5.5.1.5 Durability**

Add the following to this Sub-Clause:

All water retaining structures shall be deemed to be exposed to severe conditions. The cement/water ratio shall be determined by the strength of the concrete specified but shall not be less than 2.0.

In addition to these requirements the cementitious material content shall not be less than 325 kg/m<sup>3</sup> for structural concrete Grade 35/20.

For reinforced concrete the cement content should not exceed either 400 kg/m<sup>3</sup> of ordinary Portland cement or cements containing G.G.B.S. or 450 kg/m<sup>3</sup> where cements containing P.F.A. are used. For prestressed concrete the maximum cement content may be increased to 500 kg/m<sup>3</sup> or 550 kg/m<sup>3</sup> respectively.

### **PSG 5.5.1.7 Strength Concrete**

Add the following to this Sub-Clause:

Before the commencement of any construction work, the Contractor shall submit a concrete mix design report to the Employer's Agent for approval. A reputable commercial laboratory shall compile this concrete mix design report.

Unless specified differently the grade of concrete to be used shall be as follows:

Employer:		Contractor:	
Witness:		Witness:	



- a. Grade 35/20: All reinforced concrete structures
- b. Grade 35/20: All paving slabs and floor slabs
- c. Grade 15/20: Unreinforced foundations, pipe encasements and blinding
- d. Grade 10/20: Mass concrete and concrete filling
- e. Grade 15/10: Screeds and benching

The Grade of concrete is shown as the 28 day strength in MPa and the maximum size of the coarse aggregate in mm.

#### **PSG 5.5.2     Batching**

Add the following to this Sub-Clause:

Equipment for mass batching shall be clearly marked to show the mass of each material required for a batch.

#### **PSG 5.5.2.3     Aggregates**

Add the following to this Sub-Clause:

Batching of aggregates shall be by mass to an accuracy of within 2 % of the mass required. No volume batching will be permitted.

Water retaining concrete shall be done with the use of dolomitic aggregates.

#### **PSG 5.5.3     Mixing**

##### **PSG 5.5.3.2     Ready-Mixed Concrete**

Add the following:

Ready-mixed concrete may be used on the Site. The Contractor shall take samples for testing from every load delivered to the Site.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSG 5.5.5 Placing**

Add the following:

Concreting of the floor between construction joints shall be carried out in both directions from a point on the floor in order to close the gap with fresh concrete.

#### **PSG 5.5.6 Compaction**

Add the following to this Sub-Clause:

**PSG 5.5.6.3** Compaction shall be carried out by mechanical vibration with suitably sized equipment. Compaction by hand shall not be permitted.

**PSG 5.5.6.5** Particular care shall be taken with the top section of the walls of the reservoir to prevent cracking.

#### **PSG 5.5.7 Construction Joints**

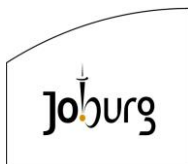
Add the following:

Should the Contractor's method of construction necessitate the placing of a construction or other joint in a position not shown on the Drawings, such method of construction and position of the joint shall be approved by the Employer's Agent in writing. The cost of such joint shall be included in the tendered rates and shall include scabbling of the concrete where steel reinforcement is continuous.

**PSG 5.5.7.1b)** Install a controlled expansion self-healing concrete waterstop (Size: 19 x 25 x 5mm), guaranteed as a system with the crystalline waterproofing additive with tracing agent, to primed joint surface between concrete pours by an approved applicator as per manufacturer's instructions.

**PSG 5.5.7.3 a)** Construction joints when concrete is not more than 24 hours old:

Employer:		Contractor:	
Witness:		Witness:	



The surface of the concrete shall be brushed with a wire brush, loose material removed and the surface dampened . New concrete shall be placed directly in contact with the old concrete and compacted thoroughly.

b) Construction joints when concrete is more than 24 hours old:

The surface of the concrete shall be sand blasted or chipped with a light hammer, and swept clean. The surface shall then be wetted and allowed to become surface-dry before new concrete is placed directly in contact with the old concrete and compacted thoroughly.

Add the following Sub-Clause:

**PSG 5.5.7.3 e)** No vertical construction joints will be permitted in circular tanks.

**PSG 5.5.8** Curing and Protection

Add the following:

The curing methods of retaining the formwork in place or covering with a waterproof membrane are strongly recommended. Concrete will not be paid for unless properly cured and proof of curing is continuously visible on site.

The minimum period of moist curing shall be:

- 5 days for normal weather (temperature 18°C to 22°C, 65 % RH, low wind speeds).
- 7 days for hot weather with drying winds.
- 9 days for cold weather (temperature 5°C to 12°C).

**PSG 5.5.11 Watertight Concrete**

Add the following:

All structures shall be deemed to be water retaining unless otherwise specified.

Employer:		Contractor:	
Witness:		Witness:	



### PSG 5.5.11.1 Testing of Water Tank

For a test of liquid retention, the structure should be cleaned and initially filled to the normal maximum level with the specified liquid (usually water) at a uniform rate of not greater than 2 m in 24 h.

When first filled, the liquid level should be maintained by the addition of further liquid for a stabilizing period while absorption and autogenous healing take place. The stabilizing period may be 7 days for a maximum design crack width of 0.1 mm or 21 days for 0.2 mm or greater. After the stabilizing period the level of the liquid surface should be recorded at 24 h intervals for a test period of 7 days. During this 7-day test period the total permissible drop in level, after allowing for evaporation and rainfall, should not exceed 1/500th of the average water depth of the full tank, 10 mm or another specified amount.

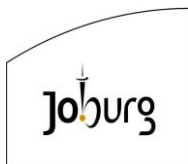
Notwithstanding the satisfactory completion of the test, any evidence of seepage of the liquid to the outside faces of the liquid-retaining walls should be assessed against the requirements of the specification. Any necessary remedial treatment of the concrete, cracks, or joints should, where practicable, be carried out from the liquid face. When a remedial lining is applied to inhibit leakage at a crack it should have adequate flexibility and have no reaction with the stored liquid.

Should the structure not satisfy the 7-day test, then after the completion of the remedial work it should be refilled and if necessary, left for a further stabilizing period; a further test of 7 days' duration should then be undertaken in accordance with this clause.

### PSG 5.5.11.2 Testing of Roofs

The roofs of liquid-retaining structures should be watertight and should, where practicable, be tested on completion by flooding the roof with water to a minimum depth of 25 mm for 24 h or longer if so specified. Where it is impracticable, because of roof falls or otherwise, to contain a 25 mm depth of water, the roof should have water applied by a continuous hose or sprinkler

Employer:		Contractor:	
Witness:		Witness:	



system to provide a sheet flow of water over the entire area of the roof for not less than 6 h. In either case the roof should be considered satisfactory if no leaks or damp patches show on the soffit. Should the structure not satisfy either of these tests, then after the completion of the remedial work it should be retested in accordance with this clause. The roof insulation and covering should be completed as soon as possible after satisfactory testing.

### **PSG 5.5.13 Grouting**

Add the following:

#### **PSG 5.5.13.1 Materials**

- a. Water - Water for grout shall comply with the requirements given in Sub-Clause 3.3 of SANS 1200 G: 1982 (2002-07-30)
- b. (Aggregates - Notwithstanding the requirements of Sub Clause 3.4.1 of SANS 1200 G, the grading of fine aggregate (sand) and coarse aggregate (stone or pea gravel) shall conform to the grading given in Tables 1 and 2, respectively, below.
- c. Cementitious material – This shall be type CEM II complying with SANS 50197-1 and of strength class 42,5 N or higher.
- d. Admixtures - Admixtures shall comply with the requirements of Sub-Clause 3.5 of SANS 1200 G: 1982 (2002-07-30) and shall have a proven record of satisfactory performance under conditions encountered in the Republic of South Africa.
- e. Proprietary grouting materials - Unless otherwise approved by the Employer's Agent, proprietary grouting materials shall be obtained ready mixed in sealed pockets as supplied by the manufacturers.

Employer:		Contractor:	
Witness:		Witness:	

TABLE 1 - SAND		TABLE 2 - STONE OR PEA GRAVEL	
1	2	1	2
Test sieve nominal aperture size (mm)	% Passing (by mass)	Test sieve nominal aperture size, (mm)	% Passing (by mass)
9,75	100	9,5	100
4,75	95 - 100	4,74	95 - 100
1,18	45 - 65	2,36	0 - 5
0,3 (300 µm)	5 - 15		
0,15(150 µm)	0 - 5		

#### PSG 5.5.13.2 Preparation and Procedures

- a. Before a machine or structural bedplate is placed on the concrete the following steps shall be carried out:
  1. All defective concrete, laitance, dirt, oil, grease, and loose material shall be removed from the concrete foundation by bush hammering, chipping, or other means until sound clean concrete is obtained. The surface of the foundation shall be scabbled but shall not be so rough as to interfere with proper placing of the grout. All foundation bolt sleeves shall be cut out or cut off flush if the sleeves cannot be removed. The top of the foundation shall be re shaped if necessary.
  2. The underside of each steel base, particularly in the bearing areas, shall be cleaned and any burrs and ragged edges removed before the base is placed in its final location.
  3. All holding down bolt sleeves shall be thoroughly cleaned of any materials that may prevent the grout from flowing freely to the bottom of the bolt sockets.

Employer:		Contractor:	
Witness:		Witness:	



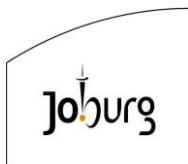
- b. The base shall be properly aligned and levelled and shall be maintained in that position during grouting.
- c. After the machine or structural bedplate has been placed the following precautions shall be observed:
  1. Shimming shall be kept to a minimum. Steel plates shall be used for packing and shall be ground to the required thickness, where necessary.
  2. Before grouting is started all loose dirt, oil, grease, and other foreign matter on the surface of the foundation, the undersides of bedplates, and in the bolt holes shall be removed by means of compressed air or other approved means. The surface of the foundation slab shall be thoroughly saturated with clean water, and all free water shall be removed from the surface and the bolt holes just before the grout is placed.
  3. Grouting shall not be carried out until the alignment of all units to be grouted has been checked and approved by the Employer's Agent.
  4. Special care shall be taken with grouting in hot or cold weather to ensure proper setting and gain of strength and, in the case of proprietary grouting materials, by having ice or hot water available, as the case may be, in accordance with the instructions of the manufacturer. Enclosures shall be provided for the grout such that, until it has set, its temperature will be in the range 15°C - 27°C.

Shields to protect the grout from the sun and from hot winds shall be provided by the Contractor when so ordered.

#### **PSG 5.5.13.3 Formwork**

Formwork for grouting shall comply with the applicable requirements of Clause 5.2 of SANS 1200 G: 1982 (2002-07-30). Forms shall be caulked where

Employer:		Contractor:	
Witness:		Witness:	



necessary. Adequate clearance between forms and bedplates shall be provided to enable the grout to be worked into place.

#### **PSG 5.5.13.4 Mixing (All Free-Flowing Grouts Except Epoxy Grouts)**

The grout shall be mixed to a homogeneous uniform mixture and delivered ready for placing at a temperature between 15 °C and 25 °C.

The materials and water shall be mixed in a mortar mixer for at least 3 min. or, in the case of small jobs only, shall be thoroughly mixed by hand, the entire mass being turned over enough times to ensure even distribution of its components.

The mixing shall be done as close as possible to the place(s) where the grout is placed. No more grout shall be mixed at any one time than can be placed in a period of 20 min. After the grout has been mixed, it shall not be retempered by the addition of water.

#### **PSG 5.5.13.5 Grouting (All Free-Flowing Grouts Except Epoxy Grouts)**

The grout shall be placed quickly and continuously to avoid the undesirable effects of over working. These effects are segregation, bleeding, and breaking down of initial set. The method of placement shall be subject to approval. The means of placing the grout shall be such that the grout will completely fill the space to be grouted, thoroughly compacted, free of air pockets, and will have evenly distributed contact over an area in excess of 80% or, in the case of expanding grout, 95% of the bearing area of the item to be supported.

Wherever practicable, grout shall be placed from one side only and where this is not practicable, care shall be taken to ensure that any entrapped air is released.

After the grout has taken its initial set:

- a. the forms shall be removed.

Employer:		Contractor:	
Witness:		Witness:	



- b. excess grout shall be so cut away as to leave a smooth and neatly finished job.
- c. except where the grout is intended to provide resistance to side thrust, all edges shall be trimmed at 45° to the vertical, from the bottom edge of the bedplate and
- d. all excess grout on or about the bedplates shall be removed.

Damage to paintwork, if any, shall be repaired within 24 hours. Packing plates, shims, and other levelling devices shall remain in position.

#### **PSG 5.5.13.6 Dry-Packed Grout (Standard Dry Sand and Cement Grout)**

Dry-packed grout shall have a minimum compressive strength at 28 d of 20 MPa. The quantity of water added after placing shall be kept to a minimum consistent with placing conditions, and the cement, sand and, where applicable, pea gravel proportions by mass shall be as follows:

- a. Where the clearance between bedplate and foundation is 25 mm or less : 1 part of cement and 2 parts of sand;
- b. Where the clearance exceeds 25 mm: 1 part of cement, 1 part of sand, and 1 part of pea gravel.

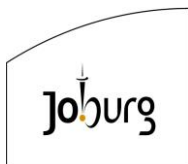
Dry packed grout shall be rammed by means of tamping rods against formwork placed along three sides of the bedplate.

#### **PSG 5.5.13.7 Non-Shrink Grout with Metallic Aggregate**

The manufacturer's instructions shall be observed when non shrink grout with metallic aggregate is used.

Where the clearance between the bedplate and the foundation is less than 50 mm a sand-based mix shall be used. Where the clearance exceeds 50 mm the Employer's Agent may order a mix with a base of sand plus pea gravel to be used.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSG 5.5.13.8 Expanding Grout with Powdered Aluminium Additive**

The manufacturer's instructions shall be observed when an expanding grout with powdered aluminium additive is used. Where the clearance between the bedplate and the foundation is less than 25 mm, a sand-based mix shall be used.

Where the clearance exceeds 25 mm the Employer's Agent may order mix with a base of sand plus pea gravel to be used.

Each batch shall be mixed for at least 6 min. after the powdered aluminium has been added. Where a ready mixed grout is used, the powdered aluminium shall be added at the placing site and the batch mixed as specified in PSG 9.4. Grout shall be placed within 45 min. after the addition of the powdered aluminium.

The Contractor shall not use powdered aluminium additive when the ambient temperature is below 5°C.

#### **PSG 5.5.13.9 Epoxy Grout (Epoxy Mortar Type Only)**

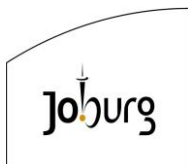
The manufacturer's instructions shall be observed when an epoxy grout is used.

#### **PSG 5.5.13.10 Testing (Clause 7)**

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy bedplate similar in configuration to that, which is to be grouted, but not exceeding 1 m in area unless otherwise ordered.

When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80 % with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95 %. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Employer's Agent.

Employer:		Contractor:	
Witness:		Witness:	



The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of Sub-Clause 7.2.1 to 7.2.3(f) SANS 1200 G: 1982 (2002-07-30).

Add the following Sub-Clauses:

**PSG 5.5.16 No Fines Concrete**

**PSG 5.5.16.1 Materials**

Cement, aggregate and water shall comply with the requirements of Clause 3 of this section.

Each size of aggregate shall be a single sized aggregate graded in accordance with SANS 1083:2006.

**PSG 5.5.16.2 Classes of No-Fines Concrete**

No fines concrete shall be classified by the prefix NF and the size of the aggregate to be used. Class NF 20 means a no fines concrete with a 19 mm nominal size aggregate.

The volume of aggregate per 50 kg of cement for each class of no fines concrete shall be as follows:

Class	Aggregate per 50 kg cement
NF 40	0,33 m <sup>3</sup>
NF 20	0,30 m <sup>3</sup>
NF 10	0,27 m <sup>3</sup>

Employer:		Contractor:	
Witness:		Witness:	



### **PSG 5.5.16.3 Batching and Mixing**

Cement shall be measured by mass or full bags of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The quantity of water added shall be just sufficient to form a smooth grout that will adhere to and completely coat each and every particle of aggregate and to be just wet enough to ensure that, at points of contact of the aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20l of water per 50 kg of cement.

Mixing shall be carried out in an approved batch type mechanical mixer, but small quantities may be hand mixed.

### **PSG 5.5.16.4 Placing**

No fines concrete shall be placed in accordance with the procedure agreed on by the Employer's Agent. It shall be placed in its final position within 30 minutes of mixing.

The no fines concrete shall be worked sufficiently to ensure that it completely fills the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming shall be avoided and under no circumstances may the no fines concrete be vibrated.

### **PSG 5.5.16.5 Protection**

All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished in one or more of the following ways:

- a. Retaining formwork in place.
- b. Covering exposed surfaces with sacking or other approved material kept continuously wet.
- c. Covering exposed surfaces with plastic sheeting.

Employer:		Contractor:	
Witness:		Witness:	



No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days.

## **PSG 5.5.17 Joints in Structures**

### **PSG 5.5.17.1 Materials**

#### **a. General**

All materials used in the forming, construction and sealing of permanent joints, as well as all proprietary or custom-built expansion joint assemblies shall be subject to the approval of the Employer's Agent.

When required by the Employer's Agent, the Contractor shall submit test certificates from an approved independent testing authority to show that the respective materials comply with the specified requirements, or a certificate from the patent holder or designer to certify that the manufactured item complies in all respects with relevant product specifications.

#### **b. Joint filler**

Joint filler shall comply with the requirements of the following specifications:

- i. American Association of State Highway Officials (A.A.S.H.O.) Standard Specification M153 54 Type I and III;
- ii. National Transport Commission "Standard Specification for Roads and Bridge Works";
- iii. Department of Public Works PW471 "Specification of Materials and Methods to be used" Section 3.13 Expansion Joints;

Joint fillers shall consist of closed cell expanded polyethylene with a density of not less than 100 kg/m<sup>3</sup>.

#### **c. Sealants**

Employer:		Contractor:	
Witness:		Witness:	



Joint sealers shall consist of a two-component polyurethane sealing compound complying with the requirements of SANS 1077: 2009 (Ed. 1.2s).

The Contractor may use other sealants if approved by the Employer's Agent after submission of full specifications and information at tender stage.

d. Waterstops

Waterstops shall be of natural rubber, or plasticized, virgin, non biodegradable PVC, and of the type specified or shown on the Drawings.

- i. Natural rubber waterstops shall comply with the requirements of CKS 388.
- ii. Flexible polyvinyl chloride (PVC) rubber waterstops shall comply with the requirements of CKS 389.

e. Accessory materials

i. Primers

When a primer is to be used in conjunction with the sealant, it shall be of the prescribed proprietary material.

ii. Adhesives

Adhesives used in conjunction with preformed seals shall be of a proven and approved type, which is compatible with the material of the seal.

iii. Bond breakers

Polyethylene tape, coated papers, metal foils or similar material may be used where bond breakers are required.

iv. Back-up material

Employer:		Contractor:	
Witness:		Witness:	



Back-up material shall consist of a compressible material of correct width and shape in order to ensure that it will be in approximately 50 % compression after installation and that the sealant can be formed to the specified depth.

Back-up materials shall be compatible with the sealant used. Material containing bitumen or volatiles shall not be used with thermosetting chemically curing sealants.

f. Bandages

Bandages shall consist of a highly flexible, waterproof and weatherproof polymer sheeting between two layers of two component, solvent free, moisture insensitive, high viscosity, epoxy paste adhesive. The material, method of application, names of supplier and instance doing the installation shall all be to the approval of the Employer's Agent.

g. Storage

All materials used in the forming, construction and sealing of permanent joints and all proprietary or custom built expansion joint assemblies shall be stored off the ground under cover that provides adequate protection against sunlight, physical or chemical damage or other factors that may cause deterioration.

**PSG 5.5.17.2 Filled Joints**

Filled joints shall be accurately formed to the dimensions shown and with the filler material specified on the Drawings. The filler shall be secured in position so that it will not be displaced during or after concreting if the filler is to remain permanently in the joint. In addition the filler shall be provided with a cut line prior to installation, e.g. factory perforated on the correct depth. This cut line, intended to aid removal of a portion of the filler to make room for the sealant, shall be in a position which coincides with the depth of the sealant.

Wherever polystyrene or a similar material, which is susceptible to damage, is used to form joints, it shall be lined with a hard surface on the side to be

Employer:		Contractor:	
Witness:		Witness:	



concreted. The hard surface shall be sufficiently resilient to ensure that the joint and surfaces can be formed free from defects.

### PSG 5.5.17.3 Sealing of Joints

#### h. General

Sealed joints shall be made watertight over the full length of the joints, unless otherwise permitted by the Employer's Agent, and the joint dimensions shall be as shown on the Drawings.

#### i. Preparation of Joints

The reaming of joints by sawing or other means shall be undertaken when edge spalling or ravelling can be avoided and shall be subject to the Employer's Agent's approval.

After removal of the temporary filler material up to the cut line or the breaking out of the excess concrete, the inside faces of the joint shall be wire brushed or grit blasted to remove all laitance and contaminants. Thereafter the joint shall be cleaned and blown out with compressed air to remove all traces of dust. Solvents shall not be used for removing contaminants from concrete and porous surfaces.

Care shall be taken to ensure that primers or adhesives are applied only to surfaces that are absolutely dry. The primer or adhesive shall be applied strictly in accordance with the manufacturer's instructions. Unless otherwise specified, the primer shall be applied within the temperature range of 10°C to 40°C and the sealant shall be applied after the curing period of the primer and within the period during which the primer remains active.

A bond breaking tape (or rope) shall be applied to the filler prior to adding the sealant in order to prevent bondage between sealant and filler.

#### j. Sealants

Employer:		Contractor:	
Witness:		Witness:	



Sealants shall be applied strictly in accordance with the manufacturer's instructions by a person skilled in the use of the particular type of sealant. The trapping of air and the formation of voids in the sealant shall be avoided. The sealant shall be finished to a neat appearance flush with the edges of the concrete or to the specified depth.

Thermoplastic hot poured sealants shall not be poured into the joints when the temperature of the joint is below 10°C. The safe heating temperature shall not exceed the specified pouring temperature by more than 10°C.

Two part thermosetting chemically curing sealants shall not be applied after expiry of the specified pot life period, which shall commence once the base and activator of the sealant have been combined.

k. Preformed compression seals

The seal shall be inserted and secured with a lubricant adhesive which covers both sides of the seal over the full area in contact with the inside faces of the joint. The lubricant adhesive shall be applied immediately before the seal is inserted.

The seal shall be installed in a compressed state, with the appropriate equipment, so that the seal will remain in compression even under the most adverse conditions. The final position of the seal shall be as shown on the Drawings or as directed by the Employer's Agent.

Joints in seals shall be bonded or fused and shall be only at positions agreed on by the Employer's Agent.

l. Waterstops

i. General requirements

The waterstops shall be supplied in unjointed standard production lengths. Site jointing shall be limited to the absolute minimum. Where lengths in excess of

Employer:		Contractor:	
Witness:		Witness:	



the standard production lengths are required, such longer lengths shall preferably be factory jointed.

At intersections, transitions and abrupt changes of direction, factory moulded watertight junction pieces shall be used so that any site jointing can be restricted to simple joints.

When a waterstop with a centre bulb is intersected, the centre bulb shall be continuous throughout the intersection irrespective of the makeup of the intersection.

ii. Rubber Waterstops

All joints shall be vulcanized and shall have a tensile strength of at least eighty (80) per cent of that of the unjointed material for water retaining structures, and fifty (50) per cent for other structures.

Site joints shall be vulcanized joints made in accordance with the requirements of these Specifications and the manufacturer's instructions, and with equipment prescribed or supplied by the manufacturer and approved by the Employer's Agent.

The vulcanizing process shall be a hot process with strict control on the pressure, the temperature and the time. The vulcanizing temperature shall be between 150 °C and 160 °C. The rubber shall not be heated above 160°C. The vulcanizing time for the specific type of rubber of the waterstops involved shall be determined with a curometer for the abovementioned vulcanizing temperatures before a vulcanized joint is made. The recommended pressure between the two sections which must be vulcanized is 3,4 MPa and the minimum allowable pressure is 2,4 MPa.

The contact faces of the sections to be jointed shall be accurately and evenly cut at the angle shown on the Drawings or prescribed by the Employer's Agent to obtain a precise fit and complete contact.

Employer:		Contractor:	
Witness:		Witness:	



Care shall be taken to keep centre bulbs unobstructed at the joints so that the lateral flexibility of the waterstops will not be affected by the presence of clotted rubber inside the bulbs.

The rubber of the waterstop shall not have any porosity or voids between the contact faces of the sections and/or at the finished vulcanized joint, especially at the centre bulb.

The vulcanizing equipment shall comply with the following minimum requirements:

The heating elements shall be equipped with an automatic temperature control device to keep the elements at the required temperature.

It shall be equipped with an automatic temperature control device to keep the heating elements at the required temperature, with a device to measure the temperature at the vulcanizing plane, a device to measure the temperature applied to the external faces of the rubber, and with a pressure gauge to regulate the applied pressure within the specified limits in relation to the liquidity of the rubber.

During the vulcanizing process, the pressure shall be spread evenly over the entire contact area and the pressure plates shall be sufficiently rigid that they will not bend under the applied pressure. The cut-out forms of the pressure plates shall fit accurately over the waterstops so that all the faces of the waterstops will be in contact with the pressure plates.

The planes of contact of the two sections of the waterstops to be joined together shall be prevented from sliding from each other when pressure is applied to the plates.

A shield shall be available to shield the apparatus against wind, rain, etc. when joints are made in the open to ensure proper temperature control.

The apparatus as a whole shall be safe in all respects and shall comply with all the appropriate statutory requirements.

Employer:		Contractor:	
Witness:		Witness:	



iii. Plasticized, Flexible PVC Waterstops

The waterstops shall be manufactured from high quality virgin material and shall not contain any scrap or reclaimed material. The waterstops shall be light coloured to reduce heat absorption when exposed to sunlight.

The waterstops shall be precision moulded or extruded to the required cross sectional profile, they shall be free from porosity or other imperfections, and shall be provided with eyelets so that they can be securely fixed to prevent displacement during concreting.

All joints shall be butt jointed hot welded joints. Where joints cannot be factory made, Site joints shall be made in accordance with the manufacturer's instructions with equipment prescribed or supplied by the manufacturer and approved by the Employer's Agent.

**PSG 5.5.18 Building in of Pipes**

The Contractor under this Contract shall be responsible for building in or caulking and making watertight around all pipes and fittings which pass through walls or under floors of the structures, irrespective of whether the Contractor himself supplies and installs the pipes and fittings, or the Employer purchases the pipes and fittings and the Contractor under this Contract takes delivery and installs them, or some other contractor (e.g. a plant supplier) supplies and installs the pipes and fittings in recesses or through holes left in the various structures for the reception of such pipes and fittings. In the latter case, the Contractor under this Contract will be paid for forming the openings for and caulking of these pipes or fittings under the item provided for this purpose in the Schedule of Quantities.

Where pipes or specials are required to pass through or be set into concrete work, holes shall be left in the concrete.

Before commencing, the positioning in holes of any pipes/specials the Contractor shall:

Employer:		Contractor:	
Witness:		Witness:	



- a. cut the reinforcement to allow the pipe to be installed.
- b. remove all shuttering and boxing remaining in the holes.
- c. make any alterations required to the position and shape of the holes.
- d. thoroughly clean the sides of the holes so as to obtain a satisfactory bond surface for the new concrete; and

After accurately positioning the pipes/specials in their respective holes, the Contractor shall fix the pipes/specials in the holes.

Immediately before grouting is carried out by the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water. All surplus water shall be removed, and the surface covered with a layer, approximately 12 mm thick, of mortar consisting of 3 parts of concrete sand and 1 part of cement.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. Where a watertight seal is required, the concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers so as to obviate any falling away from pipe/special surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass. A spare vibrator with an independent power source shall be kept in readiness to ensure continuity of placing in the event of the breakdown of the duty vibrator.

Smooth formwork that has been suitably strengthened for use with a vibrator shall be provided for facing the concrete around each pipe/special.

Alternatively, pipes may be cast into the wall in which case the pipes shall be installed in the required position with the formwork fixed around them and the concrete worked thoroughly into contact.

#### **PSG 5.5.19 Foundations for Mechanical Equipment**

Employer:		Contractor:	
Witness:		Witness:	



The mechanical contractors shall supply the holding down bolts for all mechanical equipment, together with all dimensions and other details necessary for the construction of the pedestals and holding down bolt pockets, or the fixing of the bolts. The Contractor shall either form pockets for the holding down bolts to be installed at a later stage or he shall position the bolts before the concrete is cast as ordered by the Employer's Agent. The mechanical contractor shall fix, align and level the mechanical equipment after which the Contractor shall grout up the units solidly by filling the voids inside and under the baseplates as ordered with an approved non shrink grout.

#### **PSG 5.5.20 Testing for Watertightness**

The structure that has to be tested for water tightness shall be filled by water being gradually let in until the top water level has been reached. The water level will then be carefully noted and recorded by the Employer's Agent in relation to a fixed benchmark, and the structure shall be allowed to remain filled for a period of two weeks to permit complete absorption of water by the concrete.

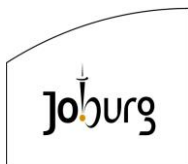
Any loss of water, which may have occurred, shall then be made up by again filling the structure to the top water level and by allowing the water to remain undisturbed for a period of not less than four days. The structure shall be considered to be watertight if the drop in level in 96 hours (less the drop caused by evaporation) does not represent more than 0,06 % of the volume of the structure.

The evaporation shall be measured by the mean drop in level caused by the evaporation of the water in three flat containers floating in the water, being recorded.

The Contractor is free to attend the taking of all measurements by the Employer's Agent.

In the event of an appreciable leakage being evident or visible at any stage of the filling or testing, or in the event of the final degree of watertightness being unsatisfactory, the Contractor shall, when so ordered by the Employer's Agent,

Employer:		Contractor:	
Witness:		Witness:	



discontinue such filling or testing that shall, at his own expense, take approved steps to rectify the leakage, until a test proves that a sufficient degree of watertightness has been obtained.

Before the expiry of the period of maintenance, the Employer's Agent shall have the right to retest the structure for watertightness; results of such further tests will be made available for the information of the Contractor. In the event of these tests indicating an unsatisfactory degree of watertightness, the Employer's Agent will, before issuing the final certificate, again require the Contractor to rectify the leakage, at his own expense, in such a manner as will cause the least interruption of the water supply to consumers and as will ensure the soundness of the work, to the satisfaction of the Employer's Agent.

Should the failure of the structure to pass the first or any subsequent test for watertightness necessitate the draining of the structure, the Employer reserves the right to itself utilise the water by discharging it into its water reticulation network, in which case the Contractor:

- i. shall not have to pay for the subsequent refilling of the structure.
- ii. shall, if applicable, reimburse the Employer for any additional costs incurred to make the water fit for consumption; and
- iii. shall not be entitled to claim for extra time whilst waiting for the water to be discharged into the network.

The costs of retesting the structure for watertightness shall be borne by the Contractor.

#### **PSG 5.5.21 Sterilization of the Reservoir**

After completion and before commissioning, the reservoir shall be cleaned, washed and disinfected.

Employer:		Contractor:	
Witness:		Witness:	

All areas inside of the structure shall be washed to the satisfaction of the Employer's Agent and thereafter it shall be brushed with a 15mg/l calcium hypochlorite solution. Upon completion of the disinfection process, the wash water shall be drained from the structure and disposed of at a suitable location offsite. Thereafter the water tightness test can be carried out.

#### **PSG 5.5.22 Repairing of Corrode Concrete Surfaces**

Concrete surfaces to be repaired shall be degreased and cleaned by means of brushing and high-pressure water washing to remove all contaminants like organics and algae to a clean and rough surface with exposed aggregate.

After approval of the cleaned surfaces by the Engineer an approved primer shall be applied followed by an approved epoxy plaster of minimum thickness of 3mm.

#### **PSG 5.5.23 Repairing of Filled and Sealed Expansion Joints**

Remove old joint sealer and ensure the vertical concrete surface is clean and all sealant is removed.

Remove all loose or friable particles.

Typical tools are steel brush and angular grinder.

Remove dust using a brush or water- and oil-free compressed air.

Where joint shoulders have collapsed, the collapsed section must be square cut at least 20mm away from the joint and broken out at least 20mm deep. This must then be cleaned out and repaired using an approved epoxy grout, ensuring the original joint size is retained.

Apply backing rod into the joint using an adequate tool. Make sure that the backing rod's skin is not damaged.

Check the position of the backing rod in order to be in line with the joint dimension calculation.

Employer:		Contractor:	
Witness:		Witness:	



Joint surfaces must be clean and dry. Apply masking tape to the surfaces next to the joint to keep excess primer off areas where it is not intended.

Apply approved primer to vertical concrete surfaces inside joint.

Apply the sealant using a caulking gun. Make sure that the sealant is in full contact with the sides of the joints.

Keeping the nozzle's tip at the joint bottom (touching the backing rod lightly) during the application does avoid air entrapment.

Self-levelling sealants are filled into the joint from foil packs with a nozzle or from another suitable pouring tool such as watering cans.

#### **PSG 5.5.24 Sealing of Wide Cracks in old Concrete**

Sawcut existing wide cracks with an angle grinder with a blade for cutting concrete a 6mm wide opening minimum 20mm deep, clean cut with a brush or compressed air, apply an approved primer and apply an approved polyurethane sealer.

### **PSG 6 TOLERANCES**

#### **PSG 6.2 Permissible Deviations**

##### **PSG 6.2.3 Specified Permissible Deviations**

Add the following:

Degree-of-accuracy II is applicable.

Every specified permissible deviation is binding in itself. The cumulative effect of permissible deviations will not be considered. The maximum permissible vertical deviation is subject to the other permissible deviations.

Replace subclause 6.2.3(d)(5) with the following:

Employer:		Contractor:	
Witness:		Witness:	



	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
"Vertically, per metre of height subject to a maximum of	5 50	3 30	2 10

## **PSG 7 TESTS**

### **PSG 7.1 Facilities and Frequency of Sampling**

#### **PSG 7.1.1 Facilities**

Add the following:

Testing will be done in accordance with SANS Methods 860, 861-3 and 863.

The Contractor shall provide sufficient storage capacity for the concrete cubes and shall arrange to have them tested by an approved laboratory.

The cost of all testing, including the cost of sampling, storage and transport of samples shall be included in the rates tendered for concrete work,

### **PSG 7.3 Acceptance Criteria For Strength Concrete**

Add the following:

Test results obtained from the supplier of ready-mixed concrete will not be accepted for evaluation in terms of subclause 7.3, but samples for testing shall be taken of such concrete at the point of placing.

## **PSG 8 MEASUREMENT AND PAYMENT**

### **PSG 8.1 Measurement and Rates**

#### **PSG 8.1.1 Formwork**

Employer:		Contractor:	
Witness:		Witness:	



DELETE "or splays over 20 mm x 20 mm" FROM THE FIRST LINE OF PARAGRAPH 8.1.1.2.

Add the following to paragraph 8.1.1.2:

"Splays up to and including 20 mm x 20 mm will not be measured separately and will be deemed to be included in the formwork costs."

Add the following paragraphs:

8.1.1.7 For construction joints at kickers, all additional costs for formwork to edges up to 300 mm high will be deemed to be included in the rates tendered for vertical formwork to sides of walls and will not be measured separately in narrow widths.

8.1.1.8 No formwork will be measured to edges of blinding layers under structures, and the cost thereof (if needed) will be deemed to be included in the rates tendered for concrete in blinding layers.

8.1.1.9 Back-shuttering or formwork to top revealed surfaces of sloping or conical formwork will only be measured to surfaces of over 40° and up to 85° to the horizontal.

8.1.1.10 Formwork to horizontal surfaces in pump stations, valve chambers, manholes or sumps can either be removed through the manhole cover opening or the Contractor may use permanent formwork at his own cost as no claims in this regard will be considered."

## **PSG 8.2 Scheduled Formwork Items**

Add the following pay item:

### **PSG 8.2.6 Box out holes/Form Voids**

Replace this pay item with the following pay item:

#### **Box out holes/Form Voids**

Employer:		Contractor:	
Witness:		Witness:	



Items will be scheduled as follows:

**(a) Cylindrical of volume:**

	Over	and	Up to and including	Unit
(i)	-		0.01m <sup>3</sup>	No
(ii)	0.01m <sup>3</sup>		0.05m <sup>3</sup>	No
(iii)	0.05m <sup>3</sup>		0.15m <sup>3</sup>	No

**(b) Cubical of volume:**

	Over	and	Up to and including	Unit
(i)	-		0.01m <sup>3</sup>	No
(ii)	0.01m <sup>3</sup>		0.05m <sup>3</sup>	No
(iii)	0.05m <sup>3</sup>		0.15m <sup>3</sup>	No

Add the following pay item:

**PSG 8.2.7 Chamfers larger than 25 mm x 25 mm**

- a. Size and member indicated **Unit: metre (m)**
- b. Ditto for other sizes **Unit: metre (m)**

The unit of measurement shall be the metre length of chamfer formwork provided. Chamfers 25 mm x 25mm and smaller will not be measured for payment and their cost shall be deemed to be included in the rates tendered for formwork.

**PSG 8.3 Reinforcement**

Replace the contents of this subclause with the following:

"The unit of measurement for steel bars shall be the ton of reinforcement in place, in accordance with the Drawings or as authorised by the Employer's Agent.

The unit of measurement for welded steel fabric shall be the square meterage of fabric reinforcement in place, and the quantity shall be calculated from the net area covered by the mesh, excluding overlaps.

Employer:		Contractor:	
Witness:		Witness:	



Clips, ties, separators, stools and other steel used for positioning reinforcement will not be measured, unless these are shown on the bending schedules.

The tendered rate shall include full compensation for the supply, delivery, cutting, bending, welding, placing and fixing of the steel reinforcement, including all tying wire, stools, supports and waste."

**PSG 8.4.3 Concrete**

Item to be priced as per SABS 1200G 8.4.3 but to include admixture specified in PSG 3.5.1.

**PSG 8.4.7 Grouting**

Rate to cover supply and installation of all grouting for ferrol holes in concrete tank walls made up of material specified in PSG 4.5.3.

**PSG 8.5 JOINTS**

Delete this pay item and add the following pay item:

**PSG 8.5.1 Expansion Joints**

Forming expansion joint (Width of joint to be stated) **unit: metre (m)**

The unit of measurement shall be the square metre net area of one face of the concrete that constitutes the joint.

The tendered rate shall cover the cost of all materials and labour for the construction of the joint as specified or shown on the drawings, including the cost of formwork, surface roughening and cleaning, testing and making good.

**PSG 8.5.2 Filled Joints**

Forming filled expansion joint (Thickness and width of joint to be stated, material of joint filler to be stated) **unit: metre (m)**

Employer:		Contractor:	
Witness:		Witness:	



The unit of measurement shall be the square metre net area of one face of the concrete that constitutes the joint.

The tendered rate shall cover the cost of all materials and labour for the construction of the joint, including formwork, supply and installation of joint filler as specified, testing and making good.

### **PSG 8.5.3 Sealed Joints**

Sealing of joints (Size of finished seal to be stated. Material of joint sealer to be stated). **Unit: metre (m)**

The unit of measurement shall be the linear metre net length of the position where the sealant is applied.

The tendered rate shall cover cost of supplying, preparing and application of the joint sealer as specified including testing and making good. Other costs related to the joint will be covered by items PSG 8.5.1 or 2 as the case may be.

### **PSG 8.5.4 Joints with Waterstop**

Separate items will be scheduled for:

- a. Waterstops in a straight-line **Unit: metre (m)**
- b. Waterstops on a curve **Unit: metre (m)**
- c. Extra-over items (a) and (b) above for factory moulded intersection pieces (described) **Unit: Number (No)**

Full description of waterstop with the relevant dimensions to be stated.

The unit of measurement shall be the linear metre net length of waterstop installed, measured along its central bulb.

The tendered rate shall cover the cost of supplying and installation of the waterstop. Other costs related to the joint will be covered by items PSG 8.5.1;

Employer:		Contractor:	
Witness:		Witness:	



2 and/or 3 as the case may be. Regarding the intersection pieces, the rate shall also include the joining of the intersection piece on site with straight or curved water stops.

**PSG 8.7 Grouting**

Add the following pay items:

**PSG 8.7(c) Grouting in of equipment supplied and installed by the Plant Supplier**

- i. using non shrink grout (state type) **unit: cubic metre (m<sup>3</sup>)**
- ii. using dry packed grout **unit: cubic metre (m<sup>3</sup>)**

The unit of measurement shall be the cubic metre of completed grouting.

The tendered rate shall include full compensation for supplying of all materials, mixing, applying and finishing to a steel float surface finish after installation of the Plant.

Add the following pay items:

**PSG 8.10 Testing Structures for Watertightness**

The unit of measurement for testing for watertightness shall be the lump sum.

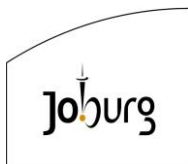
**Unit: Lump sum**

The tendered rate shall include full compensation for the provision of all labour, plant and materials necessary for testing the structure for watertightness as specified, and for emptying it afterwards, all to the satisfaction of the Employer's Agent.

**PSG 8.12 Casting in Pipes**

The tendered rate shall include full compensation for the provision of all labour, plant and materials necessary for the casting in of pipes (size, type and location indicated) as provided in Clause 5.5.18.

Employer:		Contractor:	
Witness:		Witness:	



### **PSG 8.13 Repair Corroded Concrete Surface**

The tendered rate shall include full compensation for the cleaning of the area, applying of an approved primer and an epoxy plaster of minimum thickness of 3mm all as per clause 5.5.22. The rate shall cover the cost of the cleaning equipment including power supply and all necessary consumables, scaffolding, and establishing a safe working area. **unit: square metre (m<sup>2</sup>)**

### **PSG 8.14 Repair Filled and Sealed Expansion Joints**

The tendered rate shall include full compensation for the removal of the old joint sealer, repairing of the concrete next to the joint, clean the joint, installing the new backing cord, applying masking tape next to the joint, applying approved primer on the concrete surface at the joint, applying the approved joint sealer and remove the masking tape after completion all as per clause 5.5.23. The rate shall cover the cost of supplying all the required equipment including power supply and all necessary consumables and establishing a safe working area. **unit: metre (m)**

### **PSG 8.15 Sealing of Wide Cracks in old Concrete**

The tendered rate shall include full compensation for the cutting of the crack to 6mm wide and 20mm deep, clean the cut, apply an approved primer and an approved sealant into the clean crack as per clause 5.5.24. The rate shall cover the cost of supplying all the required equipment including power supply and all necessary consumables and establishing a safe working area. **unit: metre (m)**

## **SANS 1200 H STRUCTURAL STEELWORK**

### **PSH 2 INTERPRETATION**

#### **PSH 2.1 Supporting Specifications**

- a. SANS 1200 HA

### **PSH 3. STRUCTURAL STEELWORK**

Employer:		Contractor:	
Witness:		Witness:	



Replace the contents of this clause with the following:

All structural steelwork will be to SANS 1431: 2003, Grade S355JR.

**PSH 3.6 Bolts, Nuts and Washers**

**PSH 3.6.1 Bolts and Nuts (Other than Friction Grip)**

Add the following to this Sub-Clause:

All bolts and nuts shall comply with the requirements of SANS 136 and shall be 4.6 strength grade. Washers shall be provided at each nut and shall be of the same material (or coating where applicable) to match the bolt and nut. Single coil square section spring washers shall be fitted to all nuts subject to vibration.

Bolts other than jacking bolts shall project not less than 3 mm and not more than 10 mm from the heads of the nuts after tightening. An approved nickel based anti-seize compound shall be used on all stainless steel bolts and nuts.

Unless otherwise shown all bolts, nuts and washers shall be of the material as specified below:

Holding down bolts to be built into concrete work as well as bolts to be installed above ground level directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be of the same material as the couplings or flanges. Bolts to be installed inside buildings shall be of the same material as the pipework and fittings. Corrosion protection shall be as specified in the Particular Specification G02: Corrosion Protection.

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by bi-metallic action.

**PSH 5 CONSTRUCTION**

**PSH 5.1.1 Shop Drawings**

Employer:		Contractor:	
Witness:		Witness:	



The Contractor is to provide the Employer's Agent with shop drawings at least 4 weeks before the Contract Commencement date or when that section of work has been programmed to be undertaken.

The drawings shall be compiled in the official language of the Contract. Approved/Accepted drawings shall form an integral part of the Contract documents. Drawings not accepted and signed by a professional Employer's Agent, shall not be used by the Contractor on the site of Works for construction purposes or the manufacturing of any member.

The Contractor shall submit completed drawings in accordance with this specification and shall not be entitled to claim for delays resulting from incomplete submittals that may lead to the rejection thereof. The Employer's Agent shall require a period of at least 21 working days for the reviewing of the submittals.

The following submission items are considered to be essential and shall form part of the shop drawing submittals:

- A complete material list clearly indicating the quantities of each member,
- Detail of each member showing the overall dimensions, drilling requirements and net weight, and
- Connection details for purlins fixing, bracing, sag rods and all members.

#### **PSH 5.3.9 Protective Treatment**

Delete this Sub-Clause and refer to the Particular Specification G02: Corrosion Protection.

#### **SANS 1200HA: STRUCTURAL STEELWORK (SUNDRY ITEMS)**

#### **PSHA 2 INTERPRETATION**

#### **PSHA 2.1 Supporting Specifications**

(c) SANS 1200 H

Employer:		Contractor:	
Witness:		Witness:	



**PSHA 3 MATERIALS**

**PSHA 3.3 Bolts, Nuts and Washers**

**PSHA 3.3.1 Bolts and nuts (other than friction grip)**

Add the following to this Sub-Clause:

All bolts and nuts shall comply with the requirements of SANS 136 and shall be 4.6 strength grade. Washers shall be provided at each nut and shall be of the same material (or coating where applicable) to match the bolt and nut. Single coil square section spring washers shall be fitted to all nuts subject to vibration.

Bolts other than jacking bolts shall project not less than 3 mm and not more than

10 mm from the heads of the nuts after tightening.

Holding down bolts to be built into concrete work as well as bolts to be installed above ground level directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be hot-dip galvanized in accordance with the requirements of SANS 763. Bolts to be installed inside buildings shall be hot-dip galvanized in accordance with the requirements of SANS 763 and afterwards painted with the pipework and fittings as specified in the Particular Specification G02: Corrosion Protection.

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by metallic action.

**PSHA 5.2.10 Protective treatment**

Delete this Sub Clause and refer to the Particular Specification G02: Corrosion Protection.

**PSHA 5.2.11 Handrails**

Add the following to this Sub Clause:

Employer:		Contractor:	
Witness:		Witness:	



Stanchions for handrailing shall be of approved prefabricated ball type made in one piece without welding at ball joints to accept the hand and kneerails and shall have adequate baseplates drilled for two No. M 12 bolts at appropriate centres.

Hand and kneerails shall consist of 25 mm nominal inside diameter tubing cut and bent to shape and no welding is allowed at joints. Stanchions shall be spaced not more than 1,5 metres apart. Unless otherwise shown, all handrailing shall be 900 mm above walkway level.

All tubing, stanchions and baseplates shall be manufactured in grade 304 stainless steel or hot dipped galvanized (heavy coating), as scheduled or shown on the drawings.

All stainless steel components shall have a No. 1 surface finish and surfaces shall be pickled and passivated in accordance with the requirements of the Particular Specification G02: Corrosion Protection.

#### **PSHA 5.2.12 Ladders**

Ladders shall be of all welded construction completely in accordance with the accompanying sketch. Corrosion Protection shall be carried out in accordance with the requirements of the Particular Specification G02: Corrosion Protection.

Vertical ladders may also comprise tubular stringers at 500 mm centres made of 32 mm nominal bore pipes with wall thickness not less than 3.0 mm. Rungs shall be spaced 300 mm centres and made of 20 mm nominal bore pipes with wall thickness not less than 2.5 mm.

The tubular stringers shall be drilled on one side only to provide a sliding fit for the ends of the rungs which shall protrude through these holes up to the opposite inside face of the stringer and be welded all around where they enter the holes in the stringers.

Employer:		Contractor:	
Witness:		Witness:	



Lugs for bolting these ladders to walls shall consist of 20 mm nominal bore pipes with wall thickness not less than 2.5 mm. Baseplates for stringers and lugs shall be adequate and drilled for 2 No. M12 stainless steel bolts at appropriate centres.

#### **PSHA 5.2.13 Prefabricated open grid flooring**

**PSHA 5.2.13** Add the following to this sub clause:

Open grid flooring shall be of square pattern type of approved manufacture with 40 x 4 mm minimum thickness bearer bars spaced at not more than 40 mm centres and shall be manufactured in grade 304 stainless steel or 3CR12 steel (as scheduled or as shown on the drawings). The tendered rate shall include for all cutting into the required panels, banding and for frames detailed below.

Open grid flooring shall be provided with welded frames as scheduled, made of 3CR12 steel or stainless steel as scheduled or as shown on the drawings and with dimensions 50 x 50 x 5 mm thick angle to provide a seating for the flooring. The nett clearance between the side bars of the open steel flooring and the vertical leg of the frame or strip shall be 5 mm per side. The frames shall be complete with 100 x 40 x 3 mm fishtail anchors (of the same material) fixed at 500 mm centres for building the frame into the concrete work.

Pickling and passivation shall be carried out in accordance with the requirements of the Particular Specification G02: Corrosion Protection.

#### **PSHA 5.2.14 Floorplate floors (chequer plates)**

Unless otherwise stated on the drawings or schedules, floorplate shall have a thickness of 4.5 mm and shall be of the non slip type.

The floorplate shall be made up as shown on the Drawing complete with handles, hinges and locating angles welded to the underside.

Employer:		Contractor:	
Witness:		Witness:	



The tendered rate shall include for all cutting into the required panels (and for a frame, should it be described on the drawings or schedules).

Floorplate shall be manufactured in grade 304 stainless steel or 3CR12 steel (as scheduled or as shown on the drawings) and shall be pickled and passivated as specified in the Particular Specification G02: Corrosion Protection.

#### **PSHA 5.2.17 Straps for pipes**

Straps for holding down pipes to concrete surfaces shall be manufactured in the material stated on the drawing and to the dimensions as shown on the drawing. If no dimensions or materials are shown, same shall be 50 mm wide by 3 mm thick 3CR12 steel. The strap shall be slotted and shall be fixed to the concrete by means of M10 stainless steel self drilling anchor bolts. The material between the strap and pipe shall be 8 mm thick neoprene sealing material 50 mm wide.

Pickling and passivation shall be carried out in accordance with the requirements of the Particular Specification G02: Corrosion Protection.

### **SANS 1200 L: MEDIUM PRESSURE PIPELINES**

#### **PSL 2 INTERPRETATION**

##### **PSL 2.1.2 Supporting Specifications**

Add the following to this Sub-Clause:

(h) SANS 1200 HA

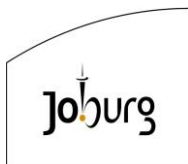
##### **PSL 2.4 Abbreviations**

Add the following to this Sub-Clause:

FC - Fibre reinforced cement

HDPE - High density polyethylene

Employer:		Contractor:	
Witness:		Witness:	



### PSL 3 MATERIALS

#### PSL 3.3 Cast Iron Pipes, Fittings And Specials

Add the following to this Sub-Clause:

All cast iron pipes and fittings shall comply with the requirements of BS2035 and unless otherwise specified, shall be of class D quality for straight pipes and of class CD quality for fittings. Material used shall comply with the requirements of SANS 1034 grade 300 for “Grey Iron Castings”.

Before leaving the foundry, all cast iron pipes and fittings shall be protected against corrosion in accordance with the Particular Specification G02: Corrosion Protection.

#### PSL 3.4 Steel Pipes, Fittings And Specials.

##### PSL 3.4.1 General

Add the following to this Sub-Clause:

Stainless steel shall be ANSI Type 304L Schedule 10 unless otherwise specified.

##### PSL 3.4.3 Pipes of Nominal Bore Over 150mm

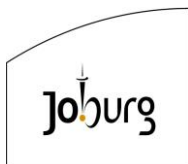
PSL 3.4.3 (a)

Replace this Sub-Clause with the following:

All pipes to comply with SANS 719 Grade “B” with wall thickness as follows:

Nominal Bore (mm)	Minimum Wall Thickness
200 – 375	4 mm
400 – 550	5 mm
600 – 700	6 mm
750 – 900	8 mm

Employer:		Contractor:	
Witness:		Witness:	



950 – 1550	10 mm
1800	14 mm

### **PSL 3.7.2 Polyethylene pipes**

Replace this Sub-Clause with the following:

All HDPE pipes and pipe fittings shall comply with SANS ISO 4427. All pipes, fittings and stub ends shall be joined through butt-welding in accordance with SANS 10112 and welding beads shall be removed on the inside only of all butt-welded joints.

### **PSL 3.8.3 Flanges and accessories**

Add the following to this Sub Clause:

Unless otherwise scheduled the dimensions and drilling of standard flanges shall comply with the requirements of SANS 1123 table 16 for pipes and fittings with a diameter of 150 mm and smaller and in accordance with table 10 for diameters exceeding 150 mm. Flanges shall be machined flat, i.e. without a raised joint face. Puddle flanges shall have the same dimensions as standard flanges but shall be undrilled.

Faces of flanges which will be in contact with jointing gaskets shall receive a protective coating similar to the corrosion protection specified for the internal surface of the pipes and fittings of such thickness and consistency as will not impair the air/gas/water tightness of the joint.

The jointing gaskets shall comply with the requirements of BS 3063 and shall be cut to the full width of the flange and holed for bolts.

All threaded bolts shall be coated with a nickel based anti-seize compound before adding the nut.

### **PSL 3.9 Corrosion Protection**

Employer:		Contractor:	
Witness:		Witness:	



Delete this Clause and refer to the Particular Specification G02: Corrosion Protection.

### PSL 3.10 Valves

Delete this Clause and add the following:

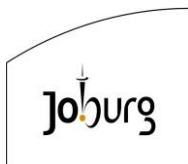
- a. Gate valves shall be double flanged with non rising spindle and shall be fitted with gun metal seats, bronze spindles and gun metal nuts. The direction of closing, which shall be clockwise when viewed from above, must be clearly indicated on the hand wheel of each valve. Gate valves shall be of standard waterworks pattern complying with the requirements of SANS 664 for working pressures as specified for each application.
- b. Reflux valves shall, except where otherwise specified, be Nitrile covered single door swing type and shall be double flanged and mounted horizontally. The design shall be such that the gate rests against the seat in the absence of flow or of differential pressure, without the aid of springs. Reflux valves shall comply with the requirements of SANS 1551-1 for working pressures as specified for each application.
- c. Butterfly valves shall be double flanged, double eccentric type and shall conform to the requirements of BS 5155.
- The valve body shall be of spheroidal graphite cast iron, grey cast iron or ductile iron. The valve body shall have integral hubs for housing shaft bearings and seals.
- Valves shall be capable of operating at any opening without variation of disc position or flutter of the disc.
- The profile of the resilient seats shall be smooth and continuous and shall provide adequate "lead in" for the resilient seal during closure of the disc to prevent excessive sealing torque requirements.

Employer:		Contractor:	
Witness:		Witness:	



- The resilient seals shall have non-weathering, non-sticking, long life properties and shall be fully locked-in, removable and replaceable.
  - Valve discs shall be of a single casting, with a streamlined shape, and shall have smooth surfaces.
  - Shafts shall be continuous or may be of the stub-shaft type. If of the stub-shaft type, each shaft shall extend into the disc hub for a distance of 1,5 times the shaft diameter.
  - Valves shall be capable of opening or closing under an unbalanced pressure equal to the specified working pressure without any difficulty. Closure of valves shall be by clockwise rotation of the handwheel (or ratchet, where specified for valve diameters of 200 mm or smaller) and shall be suitable for droptight shut-off application.
- d. Pinch Valves shall be double flanged and shall be suitable for fitting an electrically operated actuator to the valve if required and shall close in a clockwise direction when viewed from above. The valve body shall be manufactured in S.G. iron in accordance with BS EN 10213-2 grade 680. The sleeve shall be manufactured in neoprene and reinforced with steel cord. The valves shall be suitable for a working pressure as specified for each application.
- e. Plug Valves shall be flanged and shall be suitable for fitting an electrically operated actuator to the valve if required and shall close in a clockwise direction when viewed from above.
- Port arrangements shall be as specified for each application. The valve shall be antistatic and the body shall be manufactured in S.G. iron in accordance with BS EN 10213-2 grade 480. The plug shall be manufactured in stainless steel. The body of the valve shall be supplied with two surge connections for cleaning the inside of the valve. The valve shall be suitable for a working pressure as specified for each application.

Employer:		Contractor:	
Witness:		Witness:	



- f. Resilient Seal Gate Valves shall be double flanged with non rising spindle and shall conform to the requirements of SANS 664 for working pressures as specified for each application. Spindles shall be in stainless steel with bronze nuts. The direction of closing, which shall be clockwise when viewed from above, must be clearly indicated on the handwheel of each valve.
- g. Air Valves shall have single or double openings as specified and shall be manufactured, when applicable, to the same standards of quality and finish as laid down in SANS 664 for gate valves.
- Each single acting air valve shall incorporate either a large or a small orifice, as specified, and shall be fitted with a detachable copper alloy isolating gate valve.
  - Each double acting air valve shall incorporate a large and a small orifice as well as an isolating valve that forms an integral part of the air valve. Such isolating valves shall have bronze or stainless steel spindles fitted with CI cap tops and shall close clockwise.
  - The cross sectional area of the orifice openings shall be at least equal to the nominal bore of the air valve.
- h. Knife gate valves shall have a solid body casting, and shall be suitable for mounting between flanges or as a terminal valve. The knife gate valve shall have a polished 304 stainless steel gate with chamfered edge at the base.
- The gate shall seal either on a replaceable nitrile O ring or P.T.F.E. seal secured in the body. The seal shall be an internal resilient seal, mechanically retained, to ensure that the blade is guided throughout its travel and that bi-directional drop tight leak proof sealing is obtained.
  - Knife gate valves shall be fitted with rising grade 304 stainless steel spindles with non-rising hand wheels. The direction of closing, which shall be clockwise when viewed from above, shall be indicated clearly on the handwheel. The knife gate

Employer:		Contractor:	
Witness:		Witness:	



valves shall comply with the requirements of SANS 664, for working pressures as specified for each application.

- i. General: Before leaving the factory valve bodies shall be treated as follows:

Internally: 150 mm diameter and smaller: manufacturer's standard corrosion protection treatment

Internally: larger than 150 mm diameter: as specified in the Corrosion Protection Specification

Externally: as specified in the Corrosion Protection Specification.

#### **PSL 7.4 Tests on Epoxy Coatings**

Delete this Clause and refer to the Particular Specification G02: Corrosion Protection Specification for Civil, Mechanical and Electrical Engineering Construction (Golder Associates, 2006 Edition).

### **PSL 8 MEASUREMENT AND PAYMENT**

#### **PSL 8.2.5 Supply and Place Pipes, Valves And Specials**

Replace this Pay Item with the following Pay Item:

Supply, testing and installation of pipework, fittings and specials as detailed in the Pipe Schedule of the Schedule of Quantities **Unit: Sum**

The tendered sum shall include full compensation for the supply of all material, bolts, nuts and gaskets as described under PSH 3.6.1, manufacture of the pipes, fittings and specials and shall further include for delivery, installation, jointing, testing, holding in position during concrete encasing, blanking off ends to prevent ingress of foreign matter, cleaning out pipes, fittings and specials before connecting up and the full corrosion protection of pipes, fittings and specials as specified in the Particular Specification G02: Corrosion Protection.

Employer:		Contractor:	
Witness:		Witness:	



Testing shall include for the supply of water, testing equipment, blank flanges, pipe plugs and all other items necessary to conduct a successful test.

## **SANS 1200 LB: BEDDING (PIPES)**

### **PSLB 3.4.1 Contractor Required to Excavate Selectively**

Notwithstanding the requirements of Sub-Clause 3.7 of SANS 1200 DB and Sub-Clause 3.4.1 of SANS 1200 LB regarding the use of selective methods of excavating, the Contractor shall use selective methods of excavating and shall provide and use plant that will enable him to avoid burying or contaminating material that is suitable and is required for bedding.

### **PSLB 3.4.2 Suitable Material Not Available from Trench Excavation**

For this Project freehaul will be regarded as haulage within the boundaries of the Site of the Works as well as 1,0 km outside the boundaries including the access road between the fence lines. This is also valid for Clause LB 8.1.5, LB 8.1.6, LB 8.2.1, LB 8.2.2.2, LB 8.2.2.3 and LB 8.2.5.

### **PSLB 5.1.2 Details of bedding**

Unless otherwise directed on the Drawings or instructed by the Employer's Agent, all pipes shall be laid on Class B bedding.

### **PSLB 5.4 Concrete Casing to Pipes**

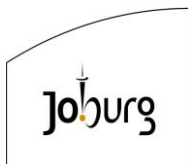
Pipes which are to be encased in concrete shall be encased in grade 10/20 concrete to the dimensions as shown on the Drawings or as instructed by the Employer's Agent.

Add the following Sub-Clause:

### **PSLB 5.5 Draining of Trenches**

Where ground water is present to such an extent that, in the opinion of the Employer's Agent, it would hamper the placing and consolidation of the fine granular bedding or the placing of the concrete bedding in the bottom of the

Employer:		Contractor:	
Witness:		Witness:	



trench, as the case may be, or would cause buoyancy of the pipes, the Employer's Agent may order the provision of a drain in the bottom of the trench to assist in dewatering during construction and until the trench has been backfilled to such an extent as to prevent buoyancy of the pipes.

The drain ordered will be as shown in the sketches of Types 1, 2, 3 and 4 Subsoil Drains attached.

At certain points along the trench, depending upon the amount of water to be handled, sumps shall be formed from which the water may be pumped to prevent a build up of water in the trench to a level above that of the top of the layer of stone forming the underdrain.

The stone in the underdrain shall consist of nominal 40 mm crushed stone complying with the grading as specified for 'Stone for Concrete' in Table 5 of SANS 1083 (as amended 1979) and shall be well compacted to provide a uniform support for the pipe bedding to be placed on top of it.

Before placing the granular bedding or the concrete bedding the underdrain shall be covered with an approved non-woven polyester geofabric of at least 210g/m<sup>2</sup> to prevent ingress of granular material or mortar into the interstices of the underdrain.

Add the following pay item:

#### **SANS 1200 LC: CABLE DUCTS**

##### **PSLC 8 Measurement and Payment**

##### **PSLC 8.2.9 Overhaul of surplus excavation**

Add the following Sub-Clause:

For this Project freehaul will be regarded as haulage within the boundaries of the Site of the Works as well as 1,0 km outside the boundaries including the access roads within the fence lines.

Employer:		Contractor:	
Witness:		Witness:	



## **SANS 1200 LD: SEWERS**

### **PSLD 5 CONSTRUCTION**

#### **PSLD 5.2 LAYING AND BEDDING**

Add the following Sub-Clauses:

##### **PSLD 5.2.5 Reinforced concrete pipes:**

Where concrete pipes are laid between structures, manholes or junction boxes, laying of pipes shall commence at the manhole or junction box at the lower end of the pipeline with full length pipes with the last pipe cut to form a closure piece for building into the structure, manhole or junction box at the upper end of the pipeline. Only the last pipe at the upper end of the pipeline shall be cut to avoid problems with jointing.

##### **PSLD 5.2.6 FC pipes:**

Where Fibre Cement (FC) pipes are laid between structures, manholes or junction boxes, laying shall commence at the lower end of the line with a short length (500 mm or 2.5 times the internal diameter of the pipe, whichever length is longer – with both ends machined to suit a flexible coupling), and thereafter by full length pipes with the last pipe cut so as to form the closure piece in the line as at the lower end of the line.

##### **PSLD 5.2.7 Cut pipes:**

In the case of concrete pipes, after the cut end has been finished off it shall be painted with two coats of bituminous paint to provide protection to the exposed ends of the reinforcing steel in the pipe.

In case of FC pipes, the cut ends shall be machined to the correct outside diameter with appropriate tools. All work performed on the cut ends shall be done to the satisfaction of the Employer's Agent.

### **PSLD 8 MEASUREMENT AND PAYMENT**

Add the following pay items:

Employer:		Contractor:	
Witness:		Witness:	



### **PSLD 8.3 Building Pipes into Brickwork**

a. Pipes supplied and installed by the Contractor (irrespective of type)

i. (state diameter of pipe) **Unit: Number (No)**

ii. (etc. for other diameters) **Unit: Number (No)**

The unit of measurement shall be the number of pipes built into the concrete work as shown on the drawing.

The tendered rate shall include full compensation for supplying all materials (wet to dry epoxy in the case of casting new concrete against the faces of old concrete) concreting in the pipes, cutting and placing formwork to fit around pipes and neatly finishing to conform to a smooth surface finish.

In the case of the Contractor building in his own pipes the rate shall also include for holding the pipe in position and aligning the pipes to the correct levels as indicated on the drawing or as ordered by the Employer's Agent.

### **PSLD 8.4 Supplying and Building High Density Polyethylene (HDPE) Or UPVC Pipes as Specified In Sans 1200 LF Into Brickwork (For Cable Sleeves Or Pipe Sleeves)**

a. State material, diameter and class **Unit: Metre (m)**

b. Etc. for other diameters **Unit: Metre (m)**

The unit of measurement shall be the linear metre of pipe installed.

The tendered rate shall include full compensation for supplying, fixing and building in of pipes. The rate shall further include for 2,5mm diameter draw wires in stainless steel and for cutting ends to the required levels for installation of cables by the Electrical Contactor or after installing pipework through ducting. The ends shall be closed with end caps to prevent ingress of rubbish and water.

Employer:		Contractor:	
Witness:		Witness:	



**PSLD 8.5      Extra Over Item LD 8.2.1 For Cutting and Painting Ends Of Concrete Pipes  
To Form Closure Pieces In The Pipeline (Measured Per Cut End)**

- a. For type or class of pipe, state diameter      **Unit: Number (No)**
- b. etc. for different class or types of pipes, state diameters

**Unit: Number (No)**

The unit of measurement shall be the number of cut ends in the pipeline. The tendered rate shall include full compensation for the cutting of the pipe, including trimming of cut ends, pipe wastage and supplying and applying two coats of bituminous paint to cut ends to protect the reinforcing steel against corrosion.

**SANS 1200LE: STORMWATER DRAINAGE**

**PSLE 1      SCOPE**

**PSLE 1.1      Add the following:**

This specification covers all the work in connection with the construction of subsurface drains and drainage blankets at the locations and to the size, shapes, grades and dimensions as shown on the Drawings or as directed by the Employer's Agent.

**PSLE 3      MATERIALS**

**PSLE 3.5      Geofabric Blanket**

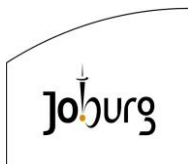
Delete this Sub Clause and refer to Sub Clause PSLE 3.7(c).

Add the following Sub Clauses:

**PSLE 3.6      Pipes**

- a. Pipes for subsurface drains shall be one of the following types as specified:

Employer:		Contractor:	
Witness:		Witness:	



- b. Perforated HDPE pipes which comply with the requirements of DIN 4262 Part 1.
- c. Perforated or slotted unplasticised PVC pipes which comply with the requirements of SANS 791.
- d. Porous concrete pipes which comply with the requirements of BS 1194.
- e. Vitrified clay pipes which comply with the requirements of SANS 559 (excepting the requirement regarding nominal diameter) and which have special joints intended for subsoil drains may be specified or used if the Employer's Agent's approval is obtained in advance, provided that, where the gaps at the joint do not conform to the requirement for the slots specified below, the grading of the permeable material shall be suitable adapted to meet the design requirements for preventing permeable material from entering the pipe.

The size of perforations in perforated pipes shall in all cases be 8 mm in diameter  $\pm 1,5$  mm, and the number of perforations per metre shall not be fewer than 26 for 100 mm pipes and 52 for 150 mm pipes. Perforations shall be spaced evenly in two rows for 100 mm pipes and in four rows for 150 mm pipes.

Slotted pipes shall have a slot width of 8 mm with a tolerance of 1,5 mm in width. The arrangement of slots shall be subject to the Employer's Agent's approval, but the total slot area shall not be less than that specified for perforations.

Pipes without slots or perforations required for transporting subsoil water from the subsoil drain proper to the point of discharge shall be unperforated pitch fibre of PVC pipes of the types specified above, or concrete pipes which comply with the requirements of SANS 677 Class A.

#### **PSLE 3.7 Permeable Material**

Employer:		Contractor:	
Witness:		Witness:	

Sand, crushed stone and geotextiles used as permeable filter materials for subsurface drains and drainage blankets shall conform to the following requirements:

a. Sand

Sand shall be clean, hard washed river sand obtained from approved sources. The grading of the sand shall be subject to the Employer's Agent's approval. The requirements in respect of each type and the comparative prices of sand from the available sources will determine which source is to be used. The Contractor shall submit samples and prices from available sources when so instructed by the Employer's Agent.

b. Crushed stone

Crushed stone shall be clean, hard, durable crushed stone from approved sources. The aggregate crushing value of the stone shall not exceed 30 when tested in accordance with method B1 of TMH1.

i. Crushed stone for graded filters

Crushed stone for graded filters shall conform to the grading requirements set out below:

Grade	Sieve size (mm)	Percentage passing by mass
Fine grade	26,5	100
	13,2	60 - 85
	3,35	15 min
	1,18	15 max
Coarse grade	26,5	100
	13,2	60 - 85
	6,70	15 min
	2,36	15 max

Employer:		Contractor:	
Witness:		Witness:	



The aggregate shall be evenly graded between the coarse and fine fractions with no undue discontinuities. The Employer's Agent shall indicate the grade of stone required.

ii. Crushed stone for filters which incorporate geotextiles

Crushed stone for filters which incorporate geotextiles shall be nominally sized stone which conforms to the grading requirements of SANS 1083, or crushed stone which complies with the grading requirements for graded filters. The Employer's Agent shall indicate the type of stone to be used in each particular case.

c. Geotextiles

Geotextiles shall be a non woven, spun or thermic bonded continuous filament fabric consisting of at least 85% by mass of poly propylene, polyester or other approved material and manufactured for civil engineering applications by a recognized manufacturer. The brand and type of geotextile to be used shall be as specified in the Project Specifications or on the Drawings or as directed by the Employer's Agent.

**PSLE 3.8 Polyethylene Sheeting**

Polyethylene sheeting shall be black in colour with a minimum thickness of 0,15 mm and manufactured by a recognized manufacturer.

**PSLE 5 CONSTRUCTION**

**PSLE 5.2.4 Pipes With Open Joints Laid With Geofabric Blanket Wrapping**

Delete this Sub Clause and refer to Sub Clause PSLE 3.6.

Add the following Sub Clauses:

**PSLE 5.8 Graded Filter Drains**

Employer:		Contractor:	
Witness:		Witness:	



After the completion of the excavations, the bottom portion of the trench shall be lined with polyethylene sheeting as shown on the Drawings. The top edges of the vertical portions of the sheeting shall be tacked to the sides of the excavation with nails or by any other suitable approved means. The sheeting shall be heat welded at the laps. Sheeting damaged during installation or construction shall be replaced at the Contractor's cost.

A layer of permeable material of the class and thickness as shown on the Drawings shall be placed on the polyethylene sheeting on the bottom of the trench and shall be lightly tamped and finished to the required gradient to serve as a bedding for the pipes.

Pipes of the type and size required shall then be firmly bedded in the permeable material, true to level and grade, and shall be coupled where required. Where spigot and socket pipes are used, the socket ends shall be laid up grade with the spigot fully entered into the adjacent socket. Where plain butt ended pipes are used, they shall be laid firmly together to prevent the infiltration of backfill material. Perforated and slotted pipes shall be joined by couplers. Perforated pipes shall be laid with the perforations at the top unless otherwise shown on the Drawings or instructed by the Employer's Agent, in writing. The higher end of a subsurface drain pipe shall be sealed off with a loose concrete cap, and at the lower end the pipe shall be built into a concrete headwall to provide a positive outlet, or it shall be connected to stormwater pipes or culverts, all as shown on the Drawings or as directed by the Employer's Agent.

Successive layers of permeable material shall be placed after the pipes have been laid. Permeable material shall be placed in layers not exceeding 300 mm at a time, and shall be lightly compacted. The total thickness of each type of permeable material shall be carefully controlled by means of spacers. When successive layers are placed, the lower layer shall not be walked on and shall, as far as is possible, not be disturbed. Care shall be taken to prevent the contamination of permeable material during construction of the subsurface drains, and all permeable material contaminated by the soil or silt shall be removed and replaced by the Contractor at his expense. Care shall also be taken at all stages not to perforate or otherwise damage the polyethylene lining.

Employer:		Contractor:	
Witness:		Witness:	



The remainder of the trench shall be immediately backfilled with approved impermeable material preferably obtained from the excavations, in layers not exceeding 100 mm and compacted to 90% of modified AASHTO density, unless otherwise ordered by the Employer's Agent. The trench must be specially protected against the ingress of water, soil and silt until the backfilling with impermeable material has been completed.

Permeable material in subsoil drains shall not be taken to the surface but shall be discontinued at such heights as will be determined by the Employer's Agent.

Any section of a subsurface drain constructed from pipes without perforations or slots shall be backfilled with impermeable backfill material as described above.

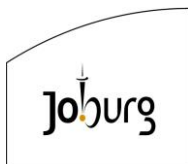
#### **PSLE 5.9 Filter Drains Which Incorporate Geotextiles**

After the completion of the excavations, the bottom portion of the trench shall be lined with geotextile sheeting as shown on the Drawings. The top edges of the vertical portions of the geotextile sheeting shall be tacked to the sides of the excavation with nails or by another suitable approved means. An overlap of at least 200 mm shall be provided at each joint. Geotextile sheeting damaged during the installation or construction shall be replaced at the Contractor's cost.

The specifications set out in PSLE 5.8 above for the construction of the pipe bedding, the pipe laying, and the placing of the crushed stone filter materials for graded filter drains shall apply mutatis mutandis to filter drains which incorporate geotextiles.

After the pipes have been laid and the specified layer of crushed stone filter material has been completed, the protruding vertical sections of the geotextile sheeting shall be folded back across the filter material so that the filter material will be completely enwrapped in the geotextile sheeting. An overlap of at least 200 mm shall be provided between the portions folded back.

Employer:		Contractor:	
Witness:		Witness:	



The specifications set out in Sub Clause PSLE 5.8 above shall apply mutatis mutandis to the placing of the remaining layers of permeable material and the top layer of impermeable material, all as shown on the Drawings or ordered by the Employer's Agent.

#### **PSLE 5.10 Drainage Blankets**

Drainage blankets shall be constructed in accordance with the details shown on the Drawings. Firstly geotextile sheeting shall be laid on top of the layer on which the drainage blanket is constructed. Then permeable material of the type specified shall be spread on the geotextile sheeting to the specified depth. The Contractor shall take care not to damage the geotextiles. The permeable material shall be lightly compacted and finished to the required level. To complete the drainage blanket, geotextile sheeting shall be laid on the layer of permeable material.

The layers on top of the drainage blanket shall be constructed in such a manner that the permeable material or the geotextile sheeting will not be displaced or damaged. Normally material which is to be compacted on top of the drainage blanket shall be watered and mixed before it is placed on the blanket. It shall then only be necessary to level and compact the material on the blanket.

#### **PSLE 8 MEASUREMENT AND PAYMENT**

Add the following pay items:

##### **PSLE 8.2.17 Pipes In Subsurface Drains**

- (a) (Type of pipe indicated) complete with couplings:
  - (i) 110mm diameter perforated uPVC pipe **Unit: Metre (m)**
  - (ii) etc. for other diameters **Unit: Metre (m)**
- (b) (Type of fitting indicated)
  - (i) (diameter indicated) **Unit: Number (No)**

Employer:		Contractor:	
Witness:		Witness:	



(ii) etc. for other diameters **Unit: Number (No)**

(c) Etc. for other types of pipes

(d) Etc. for other types of fittings

The unit of measurement for pipes shall be the metre of pipe, measured in place along its centre line, including the length of fittings. The unit of measurement for fittings shall be the number of fittings, irrespective of the type.

The tendered rate shall include full compensation for the supply and construction of the pipes and fittings as specified.

#### **PSLE 8.2.18 Polyethylene Sheeting**

(State thickness or an equivalent approved material, for lining subsurface drains) Unit: Square metre (m<sup>2</sup>)

The unit of measurement shall be the square metre of polyethylene sheeting installed, measured net from the specified dimensions.

The tendered rate shall include full compensation for the supply and construction of the sheeting as specified.

NOTE: For items PSLE 8.2.14 to PSLE 8.2.17 excavations for subsurface drains shall be measured in accordance with SANS 1200D or SANS 1200DB where applicable.

#### **SANS 1200 LG: PIPE JACKING**

##### **PSLG 5.1.1 Authority to Jack Pipeline under Facilities Controlled by Third Parties**

Add the following:

The Contractor shall be bound by and shall observe the requirements and/or conditions imposed by the service provider in granting any such permission as specified. Although the general supervision and control of the Works falls under

Employer:		Contractor:	
Witness:		Witness:	



the authority of the Employer, the service provider reserves and shall have the right to instruct the Contractor directly in any matter that has a direct bearing on the safety of the service and the protection of the interests of the service provider.

#### **PSLG 5.6 Backfilling and Disposal of Excavated Material**

Add the following Sub-Clause:

The thrust and reception pits shall be backfilled with material obtained from the pit excavations. Hard and rock material shall be incorporated in the backfill only to the extent approved by the Employer's Agent. Depending on the quality of the material, the Employer's Agent may direct that it be mixed with other backfill material.

If, in the opinion of the Employer's Agent, insufficient or no suitable material is available for this purpose within the freehaul distance, and the shortage of such material has not been caused by the methods used by the Contractor, the Employer's Agent may instruct the Contractor to import sufficient suitable material. The Contractor shall so arrange his work that the importance of backfill material is kept to a minimum in respect to both quality and overhaul.

Employer:		Contractor:	
Witness:		Witness:	



## **PSU: BUILDER'S WORK**

### **PSU 1 SCOPE**

This section covers the various construction activities associated with the erection of buildings which form part of certain civil projects.

Building work shall be carried out in accordance with the National Building Regulations and the information contained in this section.

Work appurtenant to the erection of buildings such as earthworks, concrete work, structural steelwork, etc. shall be carried out as specified in the appropriate sections of these specifications and will be measured and paid for under those sections.

### **PSU 2 INTERPRETATION**

#### **PSU 2.1 Supporting Specifications**

The following specifications shall, inter alia, form part of the Contract Document:

- (a) SANS 1200A
- (b) SANS 1200D
- (c) SANS 1200G
- (d) SANS 1200HA
- (e) Particular Specification G02: Corrosion.

### **PSU 3 MATERIALS**

#### **PSU 3.1 BRICKWORK, PLASTER WORK AND FLOOR SCREEDS**

##### **a. Bricks**

Bricks shall comply with SANS 227 and shall be classified according to their intended use as defined below.

Employer:		Contractor:	
Witness:		Witness:	



Engineering bricks in both the clay and cement categories shall be durable and selected for their uniformity of dimension, with a minimum average strength of 25 MPa. These bricks shall be free from cracks, chips or defects.

Face bricks shall not require any further decorative treatment and shall be selected for their uniformity of dimension, colour and texture, with a minimum average compressive strength of 25 MPa. These bricks shall be of clay, and shall be pressed or wire cut and free from chips, cracks, stones or other defects. Water absorption shall not exceed 5 %. Special care shall be taken in the loading, stacking and handling of face bricks, as no damaged bricks may be used.

Stock bricks shall be suitable for general building work and shall have a minimum compressive strength of 15 MPa. The water absorption of stock bricks shall not exceed 10 %.

Satisfactory proof of the load bearing capacity of the bricks offered shall be submitted before deliveries are made to the Site.

Air bricks shall be well burnt terracotta and shall be free from cracks and blemishes and lined with copper mosquito gauze.

Three samples of each type of brick shall be submitted to the Employer's Agent for approval prior to the delivery of the bricks concerned. All subsequent deliveries shall be of a standard equal to or better than that of the approved samples.

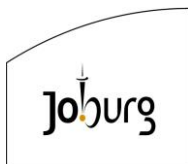
b. Wall ties

Wall ties shall be of the galvanized, crimped, single wire type with a 3,5 diameter, and shall comply with the requirements of SANS 28.

c. Damp proof sheeting

Damp proof sheeting shall comply with SANS 248, type FV for fibre felt, or SANS 952, type B for embossed polyethylene sheeting.

Employer:		Contractor:	
Witness:		Witness:	



d. Masonite

Masonite used for roof bearings on top of brick walls shall be 3 mm thick approved tempered masonite.

e. Roof bearings

Commercial roof bearings used on top of brick walls shall (unless otherwise stated) consist of an approved neoprene core protected with approved polyethylene sponge both sides, rated at 40 kN/m and which allows horizontal movement less than 2 mm.

**PSU 3.2 Ironmongery**

a. General

All steel and iron work shall be delivered clean and free from rust, pitting or other defects. Shop priming's shall be applied before delivery and shall consist of a coat of red oxide paint, or any other approved anti rust paint on all surfaces.

Unless otherwise specified, all materials shall conform at least to the appropriate SANS or BS standards where such standards apply to ironmongery, steel, cast iron or any other related materials.

b. Pressed Steel Door Frames

Pressed steel door frames shall comply with SANS 1129 and shall be manufactured from 1,6 mm thick mild steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transoms for doors shall be of the widths required to suit the thicknesses of the doors and shall be fitted with a pair of approved steel

Employer:		Contractor:	
Witness:		Witness:	



butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

Heads of frames over double doors shall be drilled where required to form keeps for bolts and shall be fitted with one rubber buffer for each leaf of the door.

Frames for single doors shall be fitted with approved chromium striking plates and adjustable striking plate keeper boxes in at the back of the frame by a welded on sheet metal box. The frames shall be fitted with a minimum of two rubber buffers.

Frames shall be protected against twisting and damage during transit and erection.

c. Pressed steel doors

Pressed steel doors shall be manufactured from 1,6 mm thick steel plate. The doors shall be of standard design, pressed to shape with 40 mm reveals all round. The doors shall be strengthened with full length vertical V shaped or other approved sectional strengthening ribs projecting to the outer face. Two horizontal stiffening rails shall also be welded to the inner face of the doors.

A door shall be hung on a pair of 100 mm long steel butt hinges with loose pins. The leaves of the hinges shall be welded to both the door and the door frame, and a 1,6 mm thick steel plate shall be welded to the inner face of the door to protect the lock.

One leaf of double doors shall be fitted at the top and bottom with approved 150 mm cast brass barrel bolts in an approved manner and the other leaf shall be fitted with a lock, the striking plate of which shall be fixed to the first leaf.

Where indicated on the Drawings, doors shall be fitted with louvered ventilation grills of approved design, backed with insect and vermin proof gauze screening.

d. Steel window frames

Employer:		Contractor:	
Witness:		Witness:	



All steel window frames shall comply with SANS 727 and shall be of the types and sizes shown on the Drawings.

Standard industrial types of steel window frames shall be constructed from rolled mild steel industrial sections, 35 mm wide by 3 mm thick, with opening sections constructed from standard residential sections, 25 mm wide by 3 mm thick, welded at angles and properly jointed at intersections.

Window frames shall be formed perfectly flat, truly square and properly jointed at all angles, and the opening portion shall fit properly on all faces and shall open and close freely.

Glazing bars shall be continuous with jointed intersections, the ends being neatly tenoned into the frame and securely welded in position.

Frames shall be fitted with standard fixing lugs.

Opening sections shall open as indicated on the Drawings, and shall be fitted with steel hinges with brass pins. Pivots shall be fitted with bronze ring centres.

Side hung or top hung opening sections shall be fitted with brass handles and friction stays. Bottom hung sections shall be fitted with friction pivots and spring catches.

Weather bar drips shall be attached to the fixed frames for the complete width of the window at the head of outward opening sections.

Composite windows may either be delivered completely assembled with mullions and transoms or as separate units for assembly on the Site, but "one piece" construction is preferred.

e. Burglar proofing for steel window frames

Burglar proofing for steel window frames shall be constructed from rolled mild steel rods of at least 12 mm diameter and welded at all intersections to form openings not exceeding 125 mm by 250 mm.

Employer:		Contractor:	
Witness:		Witness:	



Burglar proofing sections shall be formed perfectly flat, truly square where applicable and properly welded onto the window frame in such a manner that it does in no way prohibit the opening/closing of windows nor the cleaning of window panes.

Burglar proofing shall be welded/fixed to the window frame prior to the building in of the frame.

f. Door locks and handles

All door locks shall comply with the requirements of SANS 4 and shall be of approved manufacture and pattern. All locks shall be supplied with two keys. Keys shall be distinctly numbered with consecutive numbers and each key shall be stamped with the same number as that of the lock which it controls. No two locks in any one building may have the same key.

External doors shall be fitted with three lever heavy duty mortice locks, which shall be master keyed.

All locks shall be properly installed and, after completion, striker plates shall be adjusted and the locks serviced.

Door handles shall be of cast zinc of approved manufacture and pattern.

g. Miscellaneous fittings

All retaining devices for doors and windows as well as fittings such as coat hooks, retaining hooks, etc. shall be of solid brass. All fittings shall be secured by screws or set screws of the same material and finish as the fitting.

Fittings to be fixed to plastered walls, masonry or floors shall be fixed direct by means of patent plastic or fibre plugs fitted into drilled holes.

Doorstops shall be provided at every door and shall be 40 mm diameter rubber stops.

h. Valves

Employer:		Contractor:	
Witness:		Witness:	



All water taps, other than those for special hospital and similar fittings, and stop taps shall comply with the requirements of SANS 226.

Ball valves shall comply with the requirements of SANS 752.

Non swinging rotary fire hose reels shall comply with the requirements of SABS 543 with solid discs and a 25 mm waterway at the brackets. They must incorporate a Jennkin's type control valve and a rotary pressure joint at hub to hose connection. Valve handwheels are to be clearly marked with a arrow and "Open" in red.

All reels are to be fitted with the specified length of 19mm internal diameter first quality 4 ply canvas reinforced red rubber hose having a smooth black rubber core or with another equal type of hose to the approval of the Employer's Agent and the local Fire master. The hose must be firmly fixed at one end to the reel hub connection and must be so arranged that the hose coils without kinking at the joints. It must be fitted at the other end with chromium plated 19mm metal shutoff cock and an 8mm detachable nozzle. A suitable chromium plated flexible hose guide through which hose is to be permanently threaded is to be provided and securely fixed to the wall and is to be near the reel in a way which will allow the hose to be run out in any direction. A suitable chromium plated bracket is to be provided for supporting the nozzle when the hose is not in use.

### **PSU 3.3 Glazing**

#### **a. Glass**

Glass shall comply with the requirements of CKS 55. The quality of all window glass shall be such that surface deterioration will not develop after glazing.

All glass shall be free from bubbles, waviness, scratches, stains or other imperfections.

Unless otherwise specified, sheet glass for glazing shall be flat drawn clear glass of ordinary glazing quality and of the thicknesses indicated below.

Employer:		Contractor:	
Witness:		Witness:	



For panes not exceeding 0.75 m in area: 3 mm.

For panes exceeding 0.75 m but not exceeding 1,5 m in area: 5mm.

b. Putty

All putty shall comply with the requirements of SANS 680.

Putty shall not be too hard or soft or caked when used and shall dry evenly without crazing or cracking.

Defective putty shall be cut out and replaced by the Contractor at his own expense, and any broken glass shall also be so replaced and putty so repainted.

**PSU 3.4      Carpentry and Joinery**

a. Materials

All timber used for structural purposes shall be of merchantable grade and shall comply with the requirements of SANS 563 and SANS 1245. Structural timber shall be carefully selected and of the best quality, free from large or dead knots, shakes, waney edges or other defects. Purlins, battens (for roof tiles) and brandering shall comply with the requirements of SANS 653. Finger jointed structural timber shall comply with the requirements of SANS 096 and laminated timber with the requirements of SANS 1089.

Hardwoods and softwoods for joinery shall comply with SANS 1099 and SANS 1359 respectively and suitable species shall be used for the various purposes.

Unless otherwise specified, all materials shall conform to the appropriate SANS or BS specification where such standards exist for nails, screws, bolts, adhesives, etc.

b. Preservative treatment

Employer:		Contractor:	
Witness:		Witness:	



All structural timber shall be given a preservative treatment suitable for the duty for which the timber is intended in accordance with SANS 05, and no untreated timber shall be used. The preservative treatment shall not impair the final finish. The timber shall be impregnated throughout. When surface coating is specified, the compounds applied on the surfaces of the timber shall form an unbroken film.

c. Priming

The jointing surfaces of all joints exposed to the weather and built in portions of frames shall be thickly primed except where adhesives are specified.

Carpentry and joinery items which are prepared for painting by the manufacturer shall be knotted and primed before being dispatched to the Site.

Primes surfaces shall be touched up where necessary during the progress of the work or where Site adjustments have been made.

### **PSU 3.5 Roof Covering and Accessories**

a. Roof covers

i. Galvanized steel sheeting

Unless otherwise stated, galvanized steel sheeting shall have a minimum ungalvanized thickness of 0,5 mm and shall be of the profile as scheduled or shown on the Drawings. The sheeting shall comply with the requirements of an approved manufacturer's specification. The galvanizing shall comply with the relevant requirements of SANS 934 for class Z 600 coating and shall have been passivated.

ii. Fibre cement sheeting

Fibre cement sheeting shall have a minimum thickness of 5 mm, shall be of the profile as scheduled or shown on the Drawings, and shall comply with the relevant requirements of SANS 685.

Employer:		Contractor:	
Witness:		Witness:	



iii. Roofing tiles (clay and concrete)

Clay roofing tiles shall comply with the requirements of SANS specification 632, and shall be of approved pattern, free of cracks, crazing, chips, twists and other defects, of a uniform colour and equal to the sample submitted to and approved by the Employer's Agent.

Clay tiles shall be approximately 381 mm x 230 mm, weighing 2,95 kg per tile and laid to a gauge to give a coverage of 17,8 tiles to the square meter.

Concrete roofing tiles shall comply with the requirements of SANS Specification 542 and shall be of approved pattern and colour, free of cracks, crazing, chips, twists and other defects, uniform in colour and equal to a sample submitted to and approved by the Employer's Agent.

Concrete tiles shall be approximately 420 mm x 330 mm weighing 4,8 kg and shall be laid to a gauge to give a coverage of 10,25 tiles to the square meter.

Unless otherwise specified, concrete tiles shall have a natural stone granular finish.

iv. Roofing underlays

Roofing underlays for tiled roofs shall either be reinforced bitumen felt complying with BS747 type 1F or polyethylene sheeting complying with SANS 952 type C with a minimum thickness of 0,25 mm.

b. Fasteners

Fasteners and washers shall comply with the requirements of SANS 1273, shall be durable, and shall be protected against corrosion to a standard at least equal to the standard of corrosion protection of the sheeting material with which they are to be used. Fasteners to be used with fibre cement sheeting shall be hot dip galvanized fasteners and nails for roof tiles shall be made of copper, aluminium or stainless steel.

Employer:		Contractor:	
Witness:		Witness:	



Bolts and rivets used with galvanized sheeting shall be at least 4 mm in diameter, and those used with fibre cement sheeting, at least 6 mm in diameter. Nails for roof tiles shall be at least 2,8 mm thick and of sufficient length to penetrate the batten by 25 mm.

Self-tapping screws and blind rivets may be used for side stitching and as fasteners for ridging, flashings, etc.

c. Rainwater goods and flashings

Rain water goods such as launders, gutters, down pipes, etc. and flashings shall be of the size and materials as scheduled or shown on the Drawings, and the materials shall, if similar, comply with the same requirements as specified for the sheeting. All rain water goods shall be supplied complete with adequate quantities of suitably shaped brackets and fasteners.

d. Sealants

Sealants shall comply with the requirements of SANS 110, SANS 1254 or SANS 1305 as applicable or with the sheeting manufacturer's recommendations as approved by the Employer's Agent.

e. Battens

Battens for tiled roofs shall comply with clause PSU 3.4(a) and shall be of size 38 x 50 mm.

**PSU 3.6 Wall and Floor Tiles**

- a. Wall tiles shall be 'first grade' glazed ceramic tiles complying with the requirements of SANS 22 for class E tiles and shall be true and regular in shape and size and of even colour.
- b. Quarry tiles shall be the best quality pressed tiles, sound, well burnt, even in size and colour and free of markings, hollows, cracks and chips.

**PSU 3.7 Waterproofing of Concrete Roofs**

Employer:		Contractor:	
Witness:		Witness:	



Waterproofing material for concrete roof slabs shall be an approved synthetic membrane such as a multiple layer polyester reinforced acrylic membrane or other approved material capable of being fusion welded at joints to provide a homogeneous layer over the whole roof area. The membrane must be capable of withstanding extreme climatic conditions. It shall furthermore be biologically neutral, resistant to ultraviolet rays and heat, compatible with bitumen and be of a thickness of not less than 1.5 mm.

### **PSU 3.8 Paint**

Refer to the Corrosion Protection Specification for Civil, Mechanical and Electrical Engineering Construction (Golder Associates, 2006 Edition).

### **PSU 4 PLANT**

Not applicable to this Section

### **PSU 5 CONSTRUCTION**

#### **PSU 5.1 Brickwork, Plaster Work and Floor Screeds**

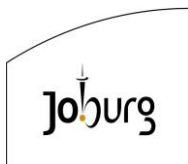
##### **PSU 5.1.1 Construction of brickwork**

###### **a. Cement mortar**

Cement mortar shall, unless otherwise specified, consist of 1 part of Portland cement to 4 parts of sand by volume for normal brickwork and 1 part of Portland cement to 3 parts of sand by volume for reinforced brickwork. The ingredients for cement mortar shall be measured in proper gauge boxes on a boarded platform and thoroughly mixed. Alternatively, mixing may be by means of an approved mechanical batch mixer. Only when the dry ingredients have been thoroughly mixed and a mixture of uniform colour has been obtained may the water be added in sufficient quantity to obtain mortar with the required consistency.

Cement mortar shall be used within two hours of adding water to the mix and shall not be used after two hours or if it has begun to set. Mortar shall be turned over frequently until it is used to prevent it from setting.

Employer:		Contractor:	
Witness:		Witness:	



b. Brickwork

Dimensions of all the brickwork shall be set out and built as shown on the Drawings. Bricks shall be kept wet before laying and the top of brickwork shall be wetted before any further bricks are laid. Bricks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds. All joints to faced brickwork shall be neatly made and key drawn with a 6 mm key.

Brickwork shall be carried up in a uniform manner with no portion being raised more than 1 m above an adjacent portion. All perpendes, quoins, etc. shall be kept strictly true and square and the whole properly bonded together.

Unless otherwise stated, brickwork shall be built in stretcher bond and bats shall not be used except where required for the bond. All joints shall be 10 mm wide and four courses shall measure 340 mm.

Brickwork for cavity walls and solid walls built in stretcher bond shall be tied with wall ties placed not more than one metre apart in every third course, and shall be staggered vertically or as otherwise specified in the Project Specifications. At openings, the ties shall be positioned not more than 300 mm apart along the periphery of the opening and 150 mm from the opening.

Face brickwork shall be kept perfectly clean. Cavities in cavity walls shall be free of any rubble. Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Employer's Agent.

c. Reinforced brickwork

Brickwork over door and window openings shall be reinforced with steel rods, welded or expanded mesh, etc. Reinforcement shall be placed in each course of brickwork for a minimum of 4 courses or as shown on the Drawings. Reinforced brickwork shall continue at least 300 mm on each side of the openings.

Employer:		Contractor:	
Witness:		Witness:	

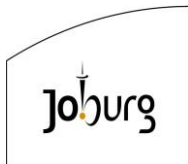
Brick lintels are to be formed of good, sound well-burnt bricks properly bonded longitudinally. They are to have a bearing of at least 330mm on each side of the opening. Where two openings are less than 1 000mm apart that lintels shall be continuous over all the openings and their dividing piers and also have at least 330mm bearing at both extreme ends. At each reveal the end bricks of the bottom course must have bearing of at least half its face length.

The number of courses in each lintel shall be at least the number of courses stated in the table below. In continuous lintels, the height shall be for the widest opening spanned. The space between the brick skins of the bottom two courses of lintels in cavity walls is to be filled in with concrete made with small aggregate. The bricks are to be bedded and jointed in 3:1 cement mortar. Particular care must be taken to ensure solid bedding, particularly where the reinforcement occurs.

Each lintel is to be reinforced with lengths of approved brick reinforcement in single layers to the full length of the lintel as set out in the table below. Brick reinforcing must be placed in the bottom courses. All brick lintels must be built upon approved rigid temporary supports left in position for at least 7 days after the lintel is completed.

Width of Opening	Thickness of Wall	No. of Brick Courses	Brick Reinforcement
Not Exceeding 1 500mm	115mm 230mm or 280mm	4	1 Run 82mm wide in each of 2 joints
		4	1 Run 158mm wide in each of 2 joints
1 500mm to 2 250mm	115mm 230mm or 280mm	6	1 Run 82mm wide in each of 4 joints.
		6	1 Run 158mm wide in each of 4 joints

Employer:		Contractor:	
Witness:		Witness:	



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BUSHKOPPIE WASTEWATER TREATMENT WORKS  
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2 250mm to 3 000mm	115mm 230mm or 280mm	8  8	1 Run 82mm wide in each of 6 joints.  1 Run 158mm wide in each of 6 joints
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Reinforcement of other diameters and strengths may be used providing the values used are equivalent to those shown in this table.

Prestressed concrete lintels may be used where approved by the Employer's Agent. Prestressed lintels are to be as manufactured and supplied by an approved manufacturer, in the appropriate widths and in the lengths to provide a minimum bearing of 225mm each side of opening. Care must be taken to avoid breakages in handling.

d. Key for plaster

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

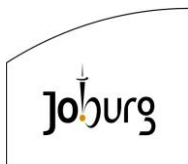
e. Damp proofing

A damp proof course shall be laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp proof course shall also be laid and stepped up under all external sills.

f. Roof bearings on top of brick walls

Top of brick wall shall be properly finished with a 10 mm thick mortar layer with steel float finish and the bearing positioned securely on the centre of the wall. Should the bearing consist of two layers of masonite, the smooth faces of the masonite should each be covered with a thin layer of approved grease and stuck together to form a sliding bearing.

Employer:		Contractor:	
Witness:		Witness:	



g. General

Rough and fair cutting shall be performed as required, and the brickwork shall be fitted around any steel work. Face brickwork shall be carefully cut and fitted to suit fittings.

Chases shall be left or formed for edges of concrete floors, staircases, etc. Chases shall also be provided wherever they may be required for pipes, conduits, switch boxes, distribution boards, and the like. Joints shall be raked out for flashings.

**PSU 5.1.2 Plaster work**

a. A plastered finish may consist of a combination of one or more of the following:

i. A single coat or first coat, comprising one application of a 1:6 cement : sand mixture with a wood or steel float finish.

If a first coat, the plaster shall be wood floated and then scratched, raked or otherwise roughened to provide a mechanical key for the second coat, which shall be applied within 24 hours. Should it be impossible to apply the second coat within 24 hours, the first coat shall be kept moist until the second coat is applied.

ii. A second coat comprising one application of a 1:6 cement : sand mixture with a wood float finish.

iii. A finishing coat comprising a 1:1½ gypsum : sand mixture with a steel float finish.

b. Thickness

The total thickness of the plaster finish shall be 10 mm minimum and 20 mm maximum.

c. Workmanship

Employer:		Contractor:	
Witness:		Witness:	



All plaster work shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb and jambs and reveals shall be formed square.

The plasterer shall cut out and make good all cracks, blisters and other defects and leave the plaster work, on completion, in a state which is acceptable to the Employer's Agent

### **PSU 5.1.3 Floor screeds**

#### **a. Normal screeds**

Normal screeds shall have a mix proportion by mass consisting of 1 part of Portland cement and 3 parts of fine aggregate. A minimum amount of water is to be used but it shall be sufficient to allow adequate compaction and activation of cement.

Screeds shall be laid on clean hardened bases, prepared as for granolithic screeds, and shall be steel trowelled to a true and smooth finish. Joints in screeds shall coincide as nearly as possible with joints in the bases. The thickness of screeds shall be as shown on the Drawings or as directed by the Employer's Agent.

The entire screed surface shall be free from loose or raised particles of aggregate, trowel marks or from any irregularities, humps or depressions exceeding 5 mm when measured from a 3 m long straight edge.

Screeds shall be cured for 3 to 7 days as may be directed by the Employer's Agent, and shall be protected from damage.

No moisture sensitive floor finish shall be laid on screeds unless a reliable moisture test shows that the screed is sufficiently dry to receive the covering.

#### **b. Granolithic screeds**

Employer:		Contractor:	
Witness:		Witness:	



Granolithic floor screeds shall be composed of 2 parts of Portland Cement to 3 parts of aggregate with sufficient water added to obtain a consistency as dry as may be practicable. The screed shall be rendered with a wood float and struck off with a steel trowel after set has commenced.

The granolithic mixture shall be floated onto the concrete floor slab within 12 hours of the latter having been laid. Where this cannot be done within 12 hours, the concrete surfaces shall be thoroughly hacked, cleaned, watered and treated with approved cement slurry or with an approved bonding agent, as may be directed before the granolithic screed is laid.

Where a tinted granolithic screed is specified, it shall be placed in two layers, a lower layer placed to within 6 mm of the finished level and an upper layer into which the pigment has been mixed. No dusting on of colouring material will be allowed.

The surface of all granolithic screeds shall be kept damp for a period of at least 7 days after laying by covering it with polyethylene sheeting or by thickly covering it with wet sand, sawdust or Hessian kept moist by frequently sprinkling it with water.

The granolithic screeds shall be not less than 20 mm thick, finished to falls as shown on the Drawings, and shall be laid in panels not exceeding 4,0 m in any direction.

Where shown on the Drawings or directed by the Employer's Agent thresholds shall be finished with granolithic screeds 25 mm thick, treads 25 mm thick, and risers 20 mm thick, including rounded nosings and reedings.

Edges next to walls shall be finished with projecting skirting, 75 mm high, with rounded top edges, unless otherwise specified or instructed by the Employer's Agent.

Employer:		Contractor:	
Witness:		Witness:	



## **PSU 5.2 Installation of Doors And Windows**

All built in door and window frames shall be set straight, plumb and level, and shall operate to the satisfaction of the Employer's Agent after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed.

## **PSU 5.3 Glazing**

Glass shall be cut in panes to suit all glazed openings with sufficient clearance all round to prevent cracking by expansion, contraction or vibration.

In all cases the glass shall be well bedded and back puttied and installed as specified in SANS Code of Practice 0137.

All putty shall be carefully trimmed, cleaned off and neatly finished off straight with smooth surfaces and sharp mitres. A paint primer shall be applied as soon as the putty has dried out sufficiently to prevent shrinkage cracks from forming.

The entire glazing operation shall be cleaned before the premises are handed over for occupation.

## **PSU 5.4 Carpentry and Joinery**

### **PSU 5.4.1 Carpentry work**

#### **a. Scope of work**

Carpentry work shall be carried out in a manner consistent with good workmanship and in compliance with the Drawings.

The carpenter shall perform all cutting away and making good in attendance upon all other trades and he shall provide and maintain temporary coverings required for the protection of any finished work that might be damaged if left unprotected during the progress of the work.

Employer:		Contractor:	
Witness:		Witness:	



b. Dimensions

"Unwrought" timber shall be "as sawn" and shall be to the dimensions and within the tolerances specified in the relevant SANS Standard Specifications mentioned in Sub Clause PSU 3.4 (a).

c. Jointing

Unless otherwise specified, all joints shall be secured by means of a suitable type and a sufficient number of approved connectors. All joints shall be carefully made in such a way that they will not impair the strength and stiffness of the beams or members.

d. Timber roof construction

The plates, joists, rafters, purlins, brandering and other pieces used for the construction of the roof and trusses shall be of the dimensions, spacing and construction, as shown on the Drawings.

All the joints in the framework shall be of the most appropriate type, accurately formed and adequately secured with fasteners as specified.

**PSU 5.4.2 Joinery work**

a. Scope of work

Joinery work shall consist of the manufacture, delivery to the Site, and fixing in the buildings, of all joinery shown on the Drawings.

Except where a special finish is specified, the Contractor shall have all stairs, landings, doors, shelves and other joinery work cleaned and scrubbed down and shall leave all his work in a good order to the satisfaction of the Employer's Agent.

b. Dimensions

Employer:		Contractor:	
Witness:		Witness:	



All "wrought" timber shall be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown on the Drawings.

Reasonable tolerance shall be provided at all connections between joinery works and the building structure to compensate adequately for any irregularities, settlements or any other movements.

c. Fabrication

The joiner shall perform all the necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all the other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for doing the specified joinery work properly.

d. Joints

Where joints are not specifically indicated, they shall be the recognised forms of joints for each position. The joints shall be so made as to comply with part 2 of BS 1186.

e. Doors and frames

Door frames, linings, panel doors, framed, ledged and braced doors, flush doors, sliding doors, etc. shall be supplied or made by the joiner and shall be installed, fitted or hung as detailed on the Drawings.

All timber shall be "wrought" and prepared for oiling, staining, varnishing or painting.

f. Skirting, cornices, etc.

Skirting, cornices, etc. shall not be installed until after the wall coverings have been applied, the flooring laid and ceilings installed, unless otherwise specified.

g. In situ joinery

Employer:		Contractor:	
Witness:		Witness:	



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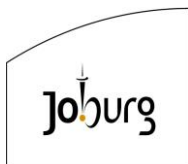


In situ joinery work shall not be executed until after all floor, wall and ceiling surfaces have been formed or constructed, unless otherwise instructed.

h. Ceilings

Ceilings shall consist of fibre cement panels as shown on the Drawings and shall be nailed to the bracing or suspended from the roof structure. The panels shall be separated by exposed tees and insulated with a 50 mm thick fibreglass wool blanket where shown on the Drawings.

Employer:		Contractor:	
Witness:		Witness:	



## **PSU 5.5      Roof Covering and Accessories**

### **a. General**

Roofs shall be left perfect and watertight on completion of the work, and all gutters and valleys shall be cleaned out.

### **b. Metal Roof sheeting**

Wherever possible, roof sheets shall be of a single length from eave to eave. However, if these lengths exceed the standard sheet lengths, the number of laps shall be kept to a minimum and shall conform to the manufacturer's recommendations for the roof slopes indicated. End laps extend beyond the purlin or rail by 150 mm.

Sheeting shall be fixed to purlins with approved screws, each complete with a galvanized steel washer over an approved sealing grommet.

The sides of sheets shall be lapped over for a minimum of one corrugation or according to the manufacturer's recommendations and shall be stitched with approved screws or blind rivets.

All laps in sheeting shall be sealed with an approved sealant. Swarf, grindings and surplus fasteners shall be removed from the roof on completion. Holes for fasteners shall be drilled and not punched.

Flashings, ridging, eaves closers, etc. shall be of the size and shape necessary to suit the sheeting used. Flashings shall be of an approved type and shall be properly cut, lapped, shaped, dressed and fixed in an approved manner to render a waterproof finish. Provision shall be made for expansion and contraction in long lengths and at expansion joints of the building.

Gutters shall be fixed on suitable brackets and shall fall to outlets, all as directed by the Employer's Agent. Gutters and brackets shall be standard units.

Employer:		Contractor:	
Witness:		Witness:	



All down pipes shall be watertight and shall be fixed 25 mm clear of the finished wall face or structure by means of suitable brackets, and at approved spacings. The positions of the down pipes shall be as directed by the Employer's Agent.

c. Roof tiling (both clay and concrete)

Note: All roofs to be tiled shall be provided with an underlay regardless of the slope of the roof.

Roof tiling shall be laid according to the "broken bond" method, and vertical joints between tiles and the bottom edge of each course of tiles, shall range perfectly straight.

For roof slopes up to 25° tile overlap shall not be less than 100 mm and for steeper slopes not less than 75 mm.

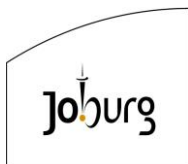
Half tiles shall be provided as required at abutments and at verges of roofs.

Unless otherwise specified, each tile in every third course, all tiles in eaves courses and ridge courses, end tiles in every course at each side of hips and valleys, half tiles and full tiles at verges, and all tiles to open eaves and open overhanging verges shall be secured to the battens with galvanised wire having a diameter of 1,6 mm passed through the holes in nibs, and wound round the battens or round stout galvanised clout-headed nails driven into the battens.

Tiling shall be carefully cut and dressed at hips and valleys and, where necessary, at abutments, etc. Mitred portions of tiles at hips and valleys shall be holed and properly secured.

Hip and ridge tiles shall be of the same material and manufacture as the roofing tiles, with a minimum cover of 75 mm over the top course of tiling on each side and with collars for overlapping joints, and shall be bedded and pointed in 1 to 3 cement mortar, with strips of approved bituminous sheeting laid under the mortar bedding of such a width as will give a lap of at least 25 mm onto the tiling at each side and lapped not less than 75 mm at end joints.

Employer:		Contractor:	
Witness:		Witness:	



All hip tiles and every fourth ridge tile shall be holed and fixed with approved nails.

The hip and ridge junction tiles, stop ends, etc. shall be of approved design, made to work in with ridging and ordinary tiles and bedded and pointed as before.

d. Roof underlays

Underlays shall be draped over the rafters in such a manner that both horizontal and vertical overlaps are at least 150 mm. The underlay shall further extend over the tiling fillet and fascia board and into the eaves gutter in such a manner that no troughs be formed behind the fascia board to inhibit the free drainage of any condensation that may be formed.

e. Setting out of tiled roofs

i. Positioning top and bottom battens

Fix the bottom batten which is to carry the eaves or first course of tiles so that it allows an overhang of the tiles over the fascia board and of one third of the gutter. Fix the top battens so that the gap between the tiles of the two ridge courses is not more than 100 mm.

ii. Batten gauge

The distance between the top of the eaves batten to the top of the top batten must be divided into equal batten gauges, which must not exceed those prescribed for the tile to be fixed (i.e. (for clay tiles) not exceeding 320 mm for roof slopes up to 25° and not exceeding 345 mm for steeper slopes).

Fixing battens

The nails for fixing battens and counter battens should be of sufficient length to penetrate the rafter by 40 mm. Ensure that all batten joints are located on a rafter.

Employer:		Contractor:	
Witness:		Witness:	



iii. Setting out tiles

Set out a full course of tiles over the eaves course, starting with the correct overhang at the right hand verge. By opening or closing all the joints between the tiles it should be possible, given a normal run of eaves, to complete the required eaves length using only whole tiles and hence eliminating cutting.

Note: All general tile patterns are designed to allow a side lock tolerance of approximately 3 mm. Hence, by using this side lock tolerance along an eaves length; tile cutting can generally be avoided.

iv. Keeping perpendicular lines true

This can be achieved by striking perpendicular chalk lines from eaves to ridge at three tile intervals. If the tiles are subsequently laid so that their edges coincide with these lines, the roof tiles will be perpendicular and a raking left-hand verge will be avoided.

v. Keeping horizontal lines true

This can be achieved by marking the batten gauge on a rod to make corresponding marks on the underlay or rafter across the roof.

Note: The bargeboard should not be fitted and the battens should not be cut until the above setting out procedure has been completed.

## PSU 5.5 Wall and Floor Tiling

- a. Tiles shall be fixed to walls with an approved adhesive and finished with white cement joints. Tiles shall be laid with straight joints and arranged symmetrically in the tiling pattern.
- b. Concrete tiles and all other types of hard tiles used as floor cover shall be bedded in cement mortar and shall be laid level. Tiles shall be laid with straight joints and flush with granolithic work, where applicable.

Employer:		Contractor:	
Witness:		Witness:	



- c. Vinyl floor tiles shall be laid level and with straight joints. the adhesive compound used and the method of laying employed shall be strictly in accordance with the tile manufacturer's instructions.

#### **PSU 5.6 Paint**

Refer to the Particular Specification G02: Corrosion Protection Specification for Civil, Mechanical and Electrical Engineering Construction (Golder Associates, 2006 Edition).

#### **PSU 5.7 Waterproofing of Concrete Roofs**

The water proofing material shall be properly bonded or stuck to the concrete slab and shall be sealed up against parapets and properly flashed, sealed and dressed down into outlets and flashed around all protrusions all as shown on the Drawings.

On completion the entire surface area of the waterproofing shall be given two coats of a reflective paint compatible with the waterproofing material and be left neat, clean and watertight.

The whole of the waterproofing installation must be carried out by specialists appointed by the manufacturer and the work must be guaranteed against any defects in material and/or workmanship for a period of ten years. Should any leaks become apparent during this time, the Contractor must undertake to have same repaired without delay and at his own cost.

#### **PSU 6 TOLERANCES**

Not applicable to this Section.

#### **PSU 7 TESTING**

Not applicable to this Section.

#### **PSU 8 MEASUREMENT AND PAYMENT**

##### **PSU 8.1 Brickwork**

Employer:		Contractor:	
Witness:		Witness:	



- a. 345 mm thick (state type of brick outside face and inside face)  
**Unit: Square metre (m<sup>2</sup>)**
- b. 230 mm thick (state type of brick outside face and inside face)  
**Unit: Square metre (m<sup>2</sup>)**
- c. 115 mm thick (state type of brick)  
**Unit: Square metre (m<sup>2</sup>)**

The unit of measurement shall be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Areas of windows, doors etc. built into brickwork shall not be included in the areas measured for payment. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rate shall include full compensation for the construction of the brickwork complete as specified, including pointing, the building in of conduits, beams, pipe sleeves, doors, windows, the raking out of joints, damp proof course, bricks on edge (if applicable) etc.

#### **PSU 8.2 Roof Bearings on Brick walls**

- a. Masonite bearings as specified (state width)  
**Unit: Metre (m)**
- b. Commercial bearing as specified (state type)  
**Unit: Metre (m)**

The tendered rate shall include full compensation for supply of material, cutting waste, applying grease where applicable and laying on top of brickwork including the mortar bed with steel trowel finish.

#### **PSU 8.3 Plaster Work**

- a. Single coat or first coat (thickness indicated)
  - i. wood float finish  
**Unit: Square metre (m<sup>2</sup>)**
  - ii. steel float finish  
**Unit: Square metre (m<sup>2</sup>)**

Employer:		Contractor:	
Witness:		Witness:	



b. Second coat (thickness indicated) **Unit: Square metre (m<sup>2</sup>)**

c. Finishing coat **Unit: Square metre (m<sup>2</sup>)**

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rate shall include full compensation for the construction of the plaster work, including the supply of all materials, mixing, applying, finishing, forming reveals, joints, etc. complete as specified.

#### **PSU 8.4 Floor Screeds**

a. Normal screeds (thickness and finish indicated) **Unit: Square metre (m<sup>2</sup>)**

b. Granolithic screeds (thickness and finish indicated) **Unit: Square metre (m<sup>2</sup>)**

c. Extra-over (a) or (b) for skirting (or nosing's or reeding) **Unit: Metre (m)**

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the Drawings or as designated by the Employer's Agent.

The tendered rate shall include full compensation for the construction of the floor screeds skirting, etc., including the supply of all materials, mixing, laying and finishing.

#### **PSU 8.5 Tiling**

a. Wall tiles (type and location) **Unit: Square metre (m<sup>2</sup>)**

b. Floor tiles (type and location) **Unit: Square metre (m<sup>2</sup>)**

c. Quarry tiles (type and location) **Unit: Square metre (m<sup>2</sup>)**

The unit of measurement shall be the square metre of each type of tile laid.

Employer:		Contractor:	
Witness:		Witness:	



The tendered rate shall include full compensation for laying, jointing and pointing of tiles, including the supply of all materials necessary to complete the tiling, including any cutting and waste, all as specified.

#### **PSU 8.6      Waterproofing of Concrete Roofs**

The unit of measurement shall be:

- |                                   |   |
|-----------------------------------|---|
| a. Main surface                   | <b>Unit: Square metre (m<sup>2</sup>)</b> |
| b. GMS or other approved flashing | <b>Unit: Metre (m)</b>                    |

The tendered rate for the main surface shall include full compensation for the supply of all material, including installation of waterproofing, welding of joints, gluing down, sealing and painting with protective paints all as specified.

The tendered rate for the flashing shall include full compensation for the supply and installation of the flashing including all fasteners and silicone sealant as specified.

#### **PSU 8.7      Rainwater Outlets**

Supply and installation of 100 mm diameter cast-iron full-bore rainwater outlet  
**Unit: Number (No)**

The unit of measurement shall be the number of outlets, installed.

- |   |                        |
|---|------------------------|
| b. Extra over item PSU 8.7(a) for the supply and installation of 80 mm diameter screwed and socketed galvanised steel pipes and fittings. |                        |
| i. (medium quality screwed and socketed pipes   | <b>Unit: Metre (m)</b> |

The unit of measurement shall be the linear metre of galvanised mild steel pipe installed

- |                       |                          |
|-----------------------|--------------------------|
| ii. etc. for fittings | <b>Unit: Number (No)</b> |
|-----------------------|--------------------------|

Employer:		Contractor:	
Witness:		Witness:	



The unit of measurement shall be the number of fittings installed.

The tendered rates shall include full compensation for the supply of material, corrosion protection as specified, including building into brickwork, cutting and threading, waste and neatly sealing and finishing waterproofing around rainwater outlets.

**PSU 8.8 Ironmongery**

**PSU 8.8.1 Doors and Windows**

- a. Steel door frames, including lintol (type and size indicated)

**Unit: Number (No)**

- b. Steel door with frame, including lintol (type and size indicated)

**Unit: Number (No)**

- c. Steel window frame, including burglar proofing, glazing, sills and lintols (type and size indicated)

**Unit: Number (No)**

The unit of measurement shall be the number of steel door frames, steel doors with frames, dark bronze anodised aluminium doors with frames, steel windows with frames, dark bronze anodised aluminium windows with frames and adjustable louvers installed complete as specified. The tendered rate shall include full compensation for the installation of the doors, windows and louvers including the supply of all materials, manufacturing, installing, hinges, handles, locks, barrel bolts, retaining devices, door stops, stays and any other work necessary to complete the work as specified. The tendered rate for windows shall also include full compensation for glazing, windowsills, lintols and dampproof sheeting all as specified. For steel window frames the supply and installation of burglar proofing shall also be included in the tendered rate. For aluminium windows the supply and installation a galvanized wire mesh (20 x 20 x 1.8 mm) screen, fixed to the inside of each adjustable louver in such a manner as not to prohibit the opening or closing of the louver as well as the supply and installation of hot dipped galvanized steel mullions between

Employer:		Contractor:	
Witness:		Witness:	



windows or where indicated on the drawing shall also be included in the tendered rate.

**PSU 8.8.2 Fixed Louvers:**

Supply and installation of approved powder coated steel louvers (state opening size)

**Unit: Number (No)**

The unit of measurement shall be the number of louvers installed.

The tendered rate shall include full compensation for cutting of openings in walls and neatly finishing after the installation, including supply of necessary materials, wooden frames or 12 mm thick plastered sills and lintols (steel float), etc.

**PSU 8.8.3 Security Gates**

Supply and fixing of security gates.

a. Mild steel gates (size and type indicated) **Unit: Number (No)**

b. (Etc. for other sizes) **Unit: Number (No)**

The unit of measurement shall be the number of gates installed complete as shown on the drawing.

The tendered rate shall include full compensation for the installation of the gates, including the supply of all materials, manufacturing, installing hinges, handles, locks, barrel bolts, retaining devices and any work necessary to complete the work as shown on the drawing. The rate shall further include for corrosion protection of the mild steel and applying a final coat of paint after erection. Colour to be approved by the Employer's Agent.

**PSU 8.11 Joinery**

a. Doors (type and size indicated) **Unit: Number (No)**

Employer:		Contractor:	
Witness:		Witness:	



- b. Other items measured by number **Unit: Number (No)**
- c. Skirting (size indicated) **Unit: Metre (m)**
- d. Other items measured by length **Unit: Metre (m)**

The units of measurement shall be the number or metre of each type and/or size of joinery item specified. The tendered rate shall include full compensation for the supply of all materials, manufacture, cutting, waste, fixing and installation of the joinery items.

#### **PSU 8.14 Roof Ventilators**

- a. Roof Ventilators (Type and material indicated)

**Unit: Number (No)**

The unit of measurement shall be the number of roof ventilators installed as shown on the Drawings or directed by the Employer's Agent.

The tendered rate shall include full compensation for the installation of the ventilators, including the supply of all materials, manufacturing and sealing.

#### **PSU 8.15 Paint Work**

- a. Steel door frames (type and size indicated) **Unit: Number (No)**
- b. Steel door and frame (type and size indicated) **Unit: Number (No)**
- c. Steel window frame including burglar proofing (type and size indicated) **Unit: Number (No)**
- d. Other sheet metal work **Unit: Square metre (m<sup>2</sup>)**
- e. Structural steelwork **Unit: Kilogram (kg) weight**

Employer:		Contractor:	
Witness:		Witness:	



- |   |   |
|---|---|
| f. Plastered or concrete walls (interior) | <b>Unit: Square metre (m<sup>2</sup>)</b> |
| g. Plastered or concrete walls (exterior) | <b>Unit: Square metre (m<sup>2</sup>)</b> |
| h. Concrete soffit ceilings               | <b>Unit: Square metre (m<sup>2</sup>)</b> |

The unit of measurement for paintwork will be as stated above.

The tendered rates shall include full compensation for the supply and application to the complete satisfaction of the Employer's Agent of all protective and decorative coatings required, as specified for the various structural members in the Particular Specification G02: Corrosion Protection.

**Units: Metres (m)**

#### **PSU 8.16 Clearing and Removal of Structures**

The rendered rate shall include removal and disposal thereof of any waste products found within the structure. Waste products are to be disposed at registered waste disposal sites.

### **SECTION VA: ANCILLARY WORK: LANDSCAPING AND GRASSING**

#### **PSVA 1 SCOPE**

This section covers the landscaping and/or the establishing of vegetation in such areas as indicated on the Drawings or ordered by the Employer's Agent, in writing, including rehabilitation of borrow pits, stockpile and spoil areas and the contractor's work areas, access roads, office and store areas etc.

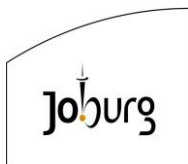
#### **PSVA 2 INTERPRETATIONS**

##### **PSVA 2.1 Supporting Specifications**

The following specifications shall, inter alia, form part of the Contract Document:

- a. SANS 1200A
- b. SANS 1200D.

Employer:		Contractor:	
Witness:		Witness:	



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**PSVA 3 MATERIALS**

**PSVA 3.1 Fertilizer**

The type of fertilizer to be used shall be as specified or ordered by the Employer's Agent or scheduled.

**PSVA 3.2 Grass Cuttings**

Grass cuttings shall be fresh and in a good condition for planting, with sufficient root material to ensure good growth. Species to be planted shall be as specified or scheduled.

**PSVA 3.3 Grass Seed**

Only good quality fresh seed shall be used. The types of seed in the mixture and the pure live seed content shall be as specified or scheduled.

**PSVA 3.4 Trees, Shrubs and Ground Covers**

Plants shall be of the variety and size shown on the Drawings.

When trees, shrubs and ground covers are supplied and delivered to the Site by the Employer, the Contractor shall give the Employer's Agent at least six weeks advance notice of his requirements. Upon receipt of the plants, the Contractor shall ensure that the plants are in good condition and free from obvious diseases and shall accept full responsibility to maintain the plants in good condition throughout the Contract. The plants shall be fully maintained and watered during this period, and any losses of plants due to lack of maintenance or diseases developing during the Contract period shall be replaced at the Contractor's expense.

Plants shall be handled and packed in the approved manner for the particular species or variety, and all necessary precautions shall be taken to ensure that plants will arrive at the point of use in proper condition for successful growth. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn. Containers shall be in a good condition.

Employer:		Contractor:	
Witness:		Witness:	



Plants supplied by the Contractor shall be healthy, shapely and well rooted. Roots shall not show any evidence of having been restricted or deformed at any time. Plants shall be well grown and free from insect pests and diseases.

#### **PSVA 3.5 Grass Sods**

Grass sods shall be of approved quality and shall be harvested, delivered and planted within 36 hours, unless otherwise authorized by the Employer's Agent. Grass sods shall be free from noxious weeds and diseases and shall contain a minimum of 30 mm of soil.

Sods shall be of the variety of grass specified or scheduled. The grass shall have been grown specifically for sod purposes, mown regularly and maintained to provide an approved quality of uniformity. It shall be harvested by special machines manufactured for this purpose to ensure an even depth of cut with sufficient root material and soil.

#### **PSVA 3.6 Anti Erosion Compounds**

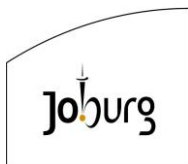
Anti erosion compounds shall consist of a plastic material in dispersion, such as Verdyol or a similar approved compound, which can be sprayed onto the soil to bind and protect it against erosion.

#### **PSVA 3.7 Topsoil**

Topsoil shall consist of fertile loamy soil selected from areas showing a good coverage of natural vegetation, preferably grasses. It shall be free from deleterious matter such as large roots, stones, refuse, stiff or heavy clays and noxious weeds, which would adversely affect its suitability for the planting of grass.

Topsoil shall be obtained wherever suitable material occurs; either from the Site or from borrow areas to be cleared, as described in Sub Clause 5.2.1.2 of SANS 1200D. The Employer's Agent shall indicate his requirements to the Contractor regarding the quantity of topsoil required and the areas at which it shall be selected and when it shall be removed. Unless otherwise specified or

Employer:		Contractor:	
Witness:		Witness:	



as instructed by the Employer's Agent, topsoil shall not be taken from more than 400 mm below the original undisturbed surface. If the Contractor fails to conserve topsoil as instructed, he shall obtain suitable substitute material from other sources at no extra cost to the Employer.

Where so specified, the Contractor shall procure and supply topsoil from his own sources outside the Site. Such sources shall be subject to the approval of the Employer's Agent.

Topsoil shall be stockpiled in separate loose heaps as tipped from the trucks and shall not be stockpiled higher than 2,0 m.

**PSVA 3.8 Manure**

Manure shall, unless another type is approved by the Employer's Agent, be pure "kraal" manure, free from soil, weed seed or other objectionable material. It shall not contain any particles that will not pass through a 50 mm screen. Only manure which has been approved by the Employer's Agent shall be delivered to the Site.

**PSVA 3.9 Compost**

Compost shall be well decayed, friable and free from weed seed, dust and other objectionable materials.

**PSVA 4 Plant**

Not applicable to this Section.

**PSVA 5 CONSTRUCTION**

**PSVA 5.1 Landscaping of Areas**

**PSVA 5.1.1 Shaping**

Areas that require shaping which involves bulk earthworks, such as contoured areas, shall be excavated, filled, compacted when required, and shaped to the correct contours to within a tolerance of plus or minus 150 mm. Such work shall

Employer:		Contractor:	
Witness:		Witness:	



be considered as earthworks and measurement and payment shall be made under SANS 1200D, except that quantities may be measured by means of a grid of levels taken at 10 m intervals before and after shaping, or by means of levelled cross sections.

#### **PSVA 5.1.2 Trimming**

Trimming shall consist of bringing the existing or previously shaped ground to an even surface with the final levels generally following the original surface. Trimming shall normally be done by grader, or, in more confined or steep areas, by bulldozer. Where machine operations are not practicable because of confined spaces or steep slopes, trimming shall be done using hand tools.

All trimming alongside roads and streets shall be completed before landscaping commences. Such trimming shall be carried out on both sides of the road or street up to the boundaries of the road reserve unless otherwise specified or instructed by the Employer's Agent.

Where applicable, trimmed surfaces shall be left slightly rough to facilitate binding with topsoil or the natural establishing of vegetation.

When subsequent grassing is required or when instructed by the Employer's Agent, areas previously shaped shall be trimmed as described above to within a tolerance of plus or minus 25 mm, with all undulations following a smooth curve. The above tolerance shall apply only to areas where the final contours are given in the Drawings.

During trimming, all stones in excess of 50 mm in size and all excess material shall be removed. The trimming of any areas requiring grass shall be done in such a way that, after cultivation and application of any topsoil, the finished surface of the area shall be approximately 25 mm below the top of adjacent kerbing, channelling or pavement.

#### **PSVA 5.1.3 Plant rates**

Employer:		Contractor:	
Witness:		Witness:	



The Employer's Agent shall be entitled to pay for shaping and trimming as described above on the basis of the hourly rates for motor graders and bulldozers. The motor grader and bulldozer to be provided shall each have a fly wheel power of not less than 93 kW. Any labour or other plant ordered shall be paid for as "extra work" as specified in Clause 5.7 of the GCC (2015).

## **PSVA 5.2 Preparation of Areas For Grassing**

The various areas to be grassed shall be prepared as follows:

### **PSVA 5.2.1 Areas Not Requiring Topsoil**

Where the areas to be grassed consist of organically suitable material, they shall be scarified to a minimum depth of 150 mm. All loose stones larger than 30 mm on areas to be mowed by machine shall be removed.

### **PSVA 5.2.2 Areas Requiring Topsoil**

Where areas to be grassed consist of organically unsuitable material, the surface shall be roughened to ensure a proper bonding between the topsoil and the subsoil. If required, the area shall be scarified as described in Sub Clause PSVA 5.2.1 above.

Topsoil shall be placed on the prepared surfaces and trimmed to the uniform thickness required. The topsoil shall be prepared by means of hand rakes or light rotavators to obtain a smooth surface. All stones shall be removed as specified for areas not requiring topsoil in Sub Clause PSVA 5.2.1 above.

### **PSVA 5.2.3 Fertilizing**

The Contractor shall have the top 150 mm of the prepared surfaces tested to determine the amount and type of fertilizer required for establishing proper growing conditions for the grass. The fertilizer shall be evenly applied over all surfaces where grass is to be planted and shall then be thoroughly mixed with the soil, either mechanically or manually, to a depth of 150 mm. Where

Employer:		Contractor:	
Witness:		Witness:	



hydroseeding is to be performed, the fertilizer may be mixed with the cellulose pulp and water used in hydroseeding.

### **PSVA 5.3 Grassing**

The method of establishing grass shall depend on the circumstances relating to each case. The method to be used in each case shall be agreed on by the Employer's Agent and the Contractor.

#### **PSVA 5.3.1 Planting Of Grass Cuttings**

The areas to be planted shall, unless they are wet, be thoroughly watered before planting to ensure that the soil will be uniformly wet over a depth of at least 150 mm during planting.

The Contractor shall plant an approved variety of grass cuttings, using his own method, in such a way as to obtain a sufficient number of live and actively growing plants per square metre to provide an acceptable cover as defined in Sub Clause PSVA 5.4.2 of this section. At least 70 grain bags of cuttings shall be planted per hectare. Only fresh cuttings shall be used. Grass cuttings that have been allowed to dry out shall not be used. Immediately after planting the grass cuttings shall be given a copious watering and when sufficiently dry shall be rolled with a light agricultural roller.

#### **PSVA 5.3.2 Sodding**

Areas to be grassed by sodding shall be given a layer of topsoil at least 75 mm thick unless the Employer's Agent instructs that the topsoil be omitted where suitable subsoil is present. The areas to be sodded shall be thoroughly watered beforehand so that they will be wet to a depth of at least 150 mm after sodding. The surface shall be slightly roughened to ensure a good penetration of roots into the soil. Sods shall be protected against drying out and shall be kept moist from the time of harvesting until finally placed.

Wherever possible, the first row of sods shall be laid in a straight line and, if on a slope, laying shall be started at the bottom of the slope. The sods shall be

Employer:		Contractor:	
Witness:		Witness:	



butted tightly against each other and care shall be taken not to stretch or overlap the sods. Where a good fit cannot be obtained, the intervening space shall be filled with topsoil. The next row shall similarly be placed tightly against the bottom row with the joints staggered, and so on, until the entire area is covered with sods. On the instructions of the Employer's Agent, sods shall be held in position on steep slopes by a sufficient number of robust wooden stakes approximately 300 mm in length by 20 mm in diameter.

Each section of completed sodding shall be lightly rolled and thoroughly watered.

### **PSVA 5.3.3 Hydroseeding**

The types and mixtures of seeds to be used shall be as specified or scheduled if not so specified and shall be agreed on by the Employer's Agent and the Contractor before any seed is ordered for use by the Contractor. The Contractor shall be solely responsible for establishing an acceptable grass cover, and any approval by the Employer's Agent of seed or seed mixtures proposed for use shall not relieve him of this responsibility.

Cellulose pulp shall be added to the hydroseeding mix at a rate of 25 kg of pulp per kilolitre of water used, except where otherwise instructed for flat slopes.

Hydroseeding shall then be carried out with the use of an approved hydroseeding machine at a rate of application of not less than 38 kg of seed mixture per hectare, unless otherwise specified in the Project Specifications.

When the use of an anti-erosion compound is required and the compound is to be applied simultaneously with the hydroseeding, it shall be mixed with the hydroseeding mixture before application. In this case the amount of cellulose pulp shall be decreased by one third to a half, depending on the amount of compound added.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSVA 5.3.4 Grassing of Borrow Pits, Temporary Bypasses, Camp Sites, Access Roads And Stockpile Sites**

Prior to any grassing that may be required on borrow areas, the finishing off of borrow pits as described in Sub Clause 5.2.2.2 of SANS 1200D, the obliteration of bypasses and access roads as described in clause 5.8 of SANS 1200A and the clearing of camp sites as described in SANS 1200A shall have been carried out as specified in the relevant sections.

#### **PSVA 5.4 Establishing and Maintenance of Grass**

##### **PSVA 5.4.1 Watering, Weeding, Cutting and Replanting**

All sodded and planted areas shall be adequately watered at frequent and regular intervals in order to ensure proper seed germination and the growth of grass until the grass has established to an acceptable cover and thereafter until the beginning of the maintenance period of the grass. The amount and frequency of watering shall be subject to the Employer's Agent's approval. Where hydroseeding is carried out, the commencement of watering may be postponed until a favourable time of the year, but watering shall in any case commence and continue as soon as the seeds have germinated and growth begins.

The Contractor shall mow the grass on all areas that have been grassed, whenever so instructed by the Employer's Agent, until the end of the contract period.

All grass cuttings shall be collected and disposed of if so directed by the Employer's Agent. Weeds shall be controlled by means of pulling or cutting or by any other approved means. Any bare patches where the grass has not taken, or where it has been damaged or has dried out shall be re-cultivated, planted, sodded or hydroseeded at the Contractor's expense.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSVA 5.4.2 Acceptable cover**

An acceptable grass cover shall mean that not less than 75% of the area planted or hydroseeded shall be covered with grass and that there shall be no bare patches the maximum dimension of which shall not exceed 500 mm. In the case of sodding, acceptable cover shall mean that the full area shall be covered with live grass at the end of any period of not less than three months after sodding.

#### **PSVA 5.5 Trees, Shrubs and Ground Covers**

##### **PSVA 5.5.1 Positions of Plants**

The positions in which trees, shrubs and ground covers are to be planted shall be as indicated on the Drawings or as determined by the Employer's Agent, and care shall be taken that the taller plants will not obscure traffic signs.

##### **PSVA 5.5.2 Preparation of Plant Holes**

Unless otherwise directed by the Employer's Agent, holes for trees and shrubs shall be placed and prepared as follows:

- a. All holes shall be square in plan.
- b. For shrubs the holes shall be at least 500 mm square by 600 mm deep.
- c. For trees the holes shall be at least 600 mm square by 700 mm deep.
- d. The planting holes shall be refilled with selected and approved topsoil, thoroughly mixed with manure or compost (one heaped spade full added to every plant hole) and, depending on soil test reports, the required amount and type of fertilizer.
- e. The holes shall be thoroughly watered before planting. Where the local soil has poor drainage, 150 mm of broken rock shall be placed at the bottom of the planting hole before filling it with soil.

Employer:		Contractor:	
Witness:		Witness:	



### **PSVA 5.5.3 Planting**

Before planting, the plants shall be well watered before they are removed from their containers.

Ground cover plants shall be carefully lifted from their containers and transferred to holes in the prepared soil, which holes shall be just large enough to accommodate the plant and the adhering soil. Care shall be taken to avoid exposure of the roots during planting. Soil for ground covers shall be prepared as for grassing as specified in clause PSVA 5.2.

Directly after the planting, plants shall be well watered to establish them firmly in the soil. After the soil has set, additional soil shall, in the case of trees and shrubs, be added where necessary to bring the backfill material to within 150 mm of the ground surface to ensure the retention of sufficient water. All trees shall be tied to a suitable creosote treated timber stake planted firmly in the ground. The stake shall have a minimum diameter of 35 mm and shall be at least 300 mm longer than the planted tree, with a maximum length of 3 m above the ground. After planting the ground surface around the plants shall be covered with straw or grass or any other type of mulch to minimize evaporation.

### **PSVA 5.6 General**

#### **PSVA 5.6.1 Time of planting**

The planting of grass, trees, shrubs and ground covers shall be carried out as far as is practicable during periods most likely to produce beneficial results. The Contractor shall make every effort to programme his operations to make this possible.

#### **PSVA 5.6.2 Traffic on Grassed Areas**

The Contractor shall not plant grass until all operations that may require construction equipment to be taken over the grassed areas have been completed. No equipment, trucks or water carts shall be allowed on areas that have been grassed and only equipment required for the preparation of areas,

Employer:		Contractor:	
Witness:		Witness:	



the application of fertilizer and the spreading of topsoil will be allowed to operate on areas ready for grassing.

#### **PSVA 5.6.3 Erosion control**

During construction, the Contractor shall protect all areas susceptible to erosion by installing all necessary temporary and permanent drainage works as soon as possible and by taking such other measures as may be necessary to prevent the concentration of surface water and the scouring of slopes, banks and other areas.

Runnels or erosion channels developing during the construction period or during the maintenance period shall be backfilled and consolidated and the affected areas shall be restored to their former proper condition. The Contractor shall not allow large scale erosion to develop before effecting repairs and all erosion damage shall be repaired as soon as possible and, in any case, not later than three months before the end of the maintenance period. Topsoil washed away shall be replaced.

#### **PSVA 5.6.4 Proprietary Brand Materials Used for Erosion Control**

Proprietary brands of materials that may be required for erosion protection to enable natural grass to become established shall be to the approval of the Employer's Agent.

#### **PSVA 5.6.5 Responsibility for Establishing An Acceptable Cover**

Notwithstanding the fact that the method of grassing and the type of seed or grass used and the rate of seed application may be specified or agreed to by the Employer's Agent, and that the frequency of mowing will be as instructed by him, the Contractor shall be solely responsible for establishing an acceptable grass cover and for the cost of replanting or re-hydroseeding where an acceptable cover has not been obtained. Where, however, in the opinion of the Contractor, it is doubtful from the outset whether an acceptable cover can be established, he may inform the Employer's Agent of his reasons for this, and the Employer's Agent shall, if he agrees, either adopt another grassing method

Employer:		Contractor:	
Witness:		Witness:	



or agree to accept whatever cover can be obtained, provided that all reasonable efforts are made to establish a good cover by the method proposed. Such agreement shall only be valid if given in writing by the Employer's Agent.

## **PSVA 5.7 Site-Specific Rehabilitation Requirements**

### **PSVA 5.7.1 Rehabilitation of Construction Activity Sites (Such As Batch Plants, Offices, Workshops, Access Roads, Borrow Areas, Etc.)**

The rehabilitation measures include:

Soil and vegetation must be rehabilitated before the last rainy season.

The following remedial action must be applied to compacted soil according to the construction areas in which they occurred:

Soils that were compacted by construction vehicles must be ripped to a depth not less than 0,5-m with a D7 or similar type tracked equipment.

Where soils were not compacted by construction vehicles the subsoil must be ripped to 150mm with a grader of similar equipment.

All soil originally stripped from the areas must be placed and spread uniformly to create a free draining area.

All oil contaminated or otherwise polluted soil and wastes from the vehicle park/site office areas must be removed to licensed landfill sites using a registered waste disposal company and a certificate obtained.

All damaged fences and gates must be repaired before rehabilitation is completed.

All roads impacted by construction must be repaired and reinstated to their original condition.

Employer:		Contractor:	
Witness:		Witness:	



## PSVA 5.7.2 Reseeding of Disturbed Areas

The primary purpose for reseeding is to facilitate the re-establishment of natural vegetation and thereby limit soil erosion. Since alien invasive species are prone to establish more quickly in disturbed areas, reseeding must be undertaken in tandem with an alien invasive plant control programme. The measures required for reseeding are given below:

All areas that were affected by construction activities must be reseeded;

All reseeding activities must be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment.

Disturbed areas must be nipped to refusal or a minimum of 500mm a mix of 2:3:2 N:P:K fertilizer at 1ton/ha must be used to soil amelioration. Disturbed areas must be harrowed after spreading 100mm topsoil uniformly.

The area must be seeded with a mix of 3 kg/ha *Eragrostis curvula*, 6kg/ha *Cynodon dactylon*, 6 kg/ha *Digitaria eriantha*, 1kg/ha *Eragrostis tef* and 6 kg/ha *Chloris gayana*.

An agricultural roller must be used to cover seeds.

Rehabilitated areas must be inspected at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures.

Appropriate remedial action must be taken where vegetation establishment has not been successful or erosion is evident.

Weeds, especially *Khakibos Tagetes minuta*, *Blackjack Bidens pilosa* must be controlled with a broadleaf herbicide that is non-toxic to the environment and is used sparingly.

Employer:		Contractor:	
Witness:		Witness:	



No construction equipment, vehicles or unauthorized personnel will be allowed onto areas that have been re-vegetated; and

Only persons/ equipment required for maintenance thereof will be allowed to operate on such areas.

**PSVA 6 TOLERANCES**

Not applicable to this Section.

**PSVA 7 TESTING**

Not applicable to this Section.

**PSVA 8 MEASUREMENT AND PAYMENT**

**PSVA 8.1 Trimming**

a. Machine trimming **Unit: Square metre (m<sup>2</sup>)**

b. Hand trimming **Unit: Square metre (m<sup>2</sup>)**

NOTE: All bulk earth moving operations as described in Sub Clause PSVA 5.1.1 shall be measured and paid for under SANS 1200D.

The unit of measurement for trimming shall be the square metre of area trimmed on the Employer's Agent's instructions, including areas trimmed after shaping.

The tendered rate shall include full compensation for trimming areas to the specified finish, including the moving of small quantities of material which would be inherent in this process, and the removal of surplus material and stones. For payment purposes a distinction shall be made between machine trimming that can reasonably be carried out by bulldozer or motor grader, and hand trimming that cannot be done by machine owing to confined space, steep slopes or difficult shapes.

Employer:		Contractor:	
Witness:		Witness:	



**PSVA 8.2 Use of Machines For Trimming Or Shaping (Alternative To Sub Item PSVA 8.1(A))**

- a. Bulldozer **Unit: Hour (h)**
- b. Motor grader **Unit: Hour (h)**

The unit of measurement shall be the hour actually worked by each machine in trimming or shaping areas. Standing time shall not be measured.

The tendered rates shall include full compensation for the supply and use of the machines, including the cost of fuel, operators, maintenance, transporting the machine to and from the point of use, and for all other incidentals necessary to carry out the work.

**PSVA 8.3 Preparing Areas for Grassing And Ground Covers**

- a. Scarifying **Unit: Hectare (ha) or square metre (m<sup>2</sup>)**
- b. Topsoiling on the Site with:
- i. Topsoil obtained from the Site or borrow areas provided by the Employer (state thickness) **Unit: Square metre (m<sup>2</sup>)**
- ii. Topsoil obtained by the Contractor from other sources (including all haulage) (state thickness) **Unit: Square metre (m<sup>2</sup>)**
- c. Topsoiling of borrow pits with topsoil obtained from borrow areas or from the Site (state thickness) **Unit: Square metre (m<sup>2</sup>)**
- d. Supplying and applying chemical fertilizers:
- i. Lime **Unit: Ton (t)**
- ii. Super phosphate **Unit: Ton (t)**
- iii. Limestone ammonium nitrate **Unit: Ton (t) or kilo gram (kg)**

Employer:		Contractor:	
Witness:		Witness:	



iv. (iv) 2:3:2 (22) **Unit: Ton (t)**

v. (v) Other fertilizers if required (type stated) **Unit: Ton (t)**

e. Stockpiling of topsoil **Unit: Cubic metre (m<sup>3</sup>)**

The unit of measurement for scarifying shall be the hectare or square metres of ground scarified and prepared as specified. Only areas scarified on the written instructions of the Employer's Agent shall be measured for payment.

The tendered rate shall include full compensation for scarifying, removing stones and smoothing the surface.

The unit of measurement for topsoiling shall be the square metre of topsoil applied to the specified thickness or as directed by the Employer's Agent, measured in situ after the topsoil has been placed. The quantity shall be calculated from the net area of the surface topsoil, before the application of grass sods. Any topsoil placed in excess of the average thickness specified or ordered shall not be measured for payment.

For payment purposes a distinction shall be made between topsoil obtained from designated areas on the Site or borrow areas and topsoil obtained by the Contractor from outside sources found by him when sufficient topsoil is not available from the said designated areas. For payment purposes a further distinction shall be made between topsoil applied to areas on the Site and topsoil applied to borrow areas.

The tendered rate shall include full compensation for constructing the topsoil as specified, including any royalties or compensation that may be payable in the case of topsoil under Sub item PSVA 8 (b) (ii).

The unit of measurement of fertilizer shall be the ton or kilogram of each type of fertilizer ordered and applied.

The tendered rate shall include full compensation for supplying the fertilizers, and for fertilizing the designated surfaces, all as specified.

Employer:		Contractor:	
Witness:		Witness:	



The unit of measurement for stockpiling of topsoil shall be the cubic metre of topsoil stockpiled on the written instructions of the Employer's Agent, where this operation is unavoidable despite proper advance planning. Only material actually loaded, transported to and stockpiled on sites designated for stockpiling shall be measured, and not any material merely pushed or bladed into heaps adjacent to the area from which it was taken.

The tendered rate shall include full compensation for removal and loading the topsoil, transporting it, placing it in stockpile, and for any payments to private owners for the use of stockpile areas.

#### **PSVA 8.4 Grassing**

- a. Planting of grass (type indicated) **Unit: Square metre (m<sup>2</sup>)**
- b. Sodding (type indicated) **Unit: Square metre (m<sup>2</sup>)**
- c. Revegetation cylinders (description) **Unit: Metre (m)**
- d. Hydroseeding:
  - i. Providing approved seed mixture for hydroseeding (type indicated) **Unit: Kilogram (kg)**
  - ii. Hydroseeding (type indicated) **Unit: Hectare (ha)**

The unit of measurement for the planting of grass cuttings shall be the square metre of established grass with an acceptable grass cover.

The tendered rate shall include full compensation for the planting of grass cuttings, the establishing of an acceptable cover, the replanting of dead areas and the maintenance of the grass, all as specified, but excluding the mowing of grass.

The unit of measurement for sodding shall be the square metre covered with sods and having an acceptable cover.

Employer:		Contractor:	
Witness:		Witness:	



The tendered rate shall include full compensation for sodding, the establishing of an acceptable cover, the replanting of dead areas, and the maintenance of the grass, all as specified, but excluding the mowing of the grass.

The unit of measurement for revegetation cylinders shall be the metre of revegetation cylinders furnished and placed as specified, measured along the rows in which they are placed end to end.

The tendered rates shall include full compensation for constructing and maintaining the revegetation cylinders, all as specified. Topsoiling shall be paid for separately under items PSVA 8.3 (b) and (c) and due allowance shall be made for excluding the volume occupied by the revegetation cylinders from the volume of topsoil measured for payment. Hydroseeding shall be paid for separately.

The unit of measurement for hydroseeding shall be the hectare of grass established by hydroseeding and having an acceptable cover. The unit of measurement for providing seed shall be the kilogram of seed of the specified mixture, excluding the mass of any pulp added thereto.

The tendered rate shall include full compensation for planting grass by hydroseeding the establishing of an acceptable cover, re-hydroseeding bare patches, and the maintenance of the grass, all as specified, but excluding the mowing of the grass.

#### General

Half the payments under item PSVA 8.4 shall become due when the grassing or hydroseeding has been carried out, and the remainder shall become due when a satisfactory cover has been established, except in the case of Sub item PSVA 8.4(c) where the full amount will become due upon the satisfactory execution of the work.

Employer:		Contractor:	
Witness:		Witness:	



**PSVA 8.5      Mowing of Grass      Unit: Hectare (ha)**

The unit of measurement shall be the hectare measured each time when the grass has been cut on the instructions of the Employer's Agent.

The tendered rate shall include full compensation for all plant, equipment and labour required for each grass cutting and the disposal of grass cuttings, i.e., payment shall be made every time the grass has been cut on the instructions of the Employer's Agent.

**PSVA 8.6      Approved Anti Erosion Compound**

Anti-erosion compound (type indicated)      **Unit: Kilogram (kg)**

The unit of measurement shall be the kilogram net mass of anti-erosion compound used as approved by the Employer's Agent.

The tendered rate shall include full compensation for supplying the material and mixing and applying it with the hydroseeding or by itself.

**PSVA 8.7      Management of Weeds      Unit: Square Meters (m<sup>2</sup>)**

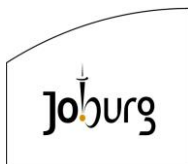
The unit of measurement shall be the square meter and shall be paid the Contractor on the instructions of the Employer's Agent.

The tendered rate shall include full compensation for all plant, equipment and labour required as well as for the disposal of the weeds.

**PSVA 8.8      Extra Work For Landscaping      Unit: Provisional sum**

The provisional sum allowed shall be expended at the discretion of the Employer's Agent to cover the cost of work in addition to the scheduled items that may be required in respect of landscaping when plant is used at hourly rates, e.g. the cost of loading and transporting surplus material, in respect of establishing the grass by topsoiling only, repairing erosion damage after topsoil has been applied, or in respect of any other items of work required for which no pay items have been provided.

Employer:		Contractor:	
Witness:		Witness:	



Payments shall be made as specified in Clause 6.6 of the GCC (2015).

#### **PSVA 8.9 Site-Specific Rehabilitation**

The cost of rehabilitation of the areas affected by the Contractor's activities on the site will be for the Contractor's account and must be provided for in the Bill of Quantities.

The requirements for rehabilitation are covered in PSVA 5.6.1 and PSVA 5.6.2.

### **SECTION VB: ANCILLARY WORK: FENCING**

#### **PSVB 1 SCOPE**

This section covers the erection of new fences, the moving of existing fences, the erection and later removal of temporary fences and the dismantling of existing fences.

#### **PSVB 1.1 Types of Fences**

The following types of fences shall be erected in accordance with the dimensions shown on the Drawings:

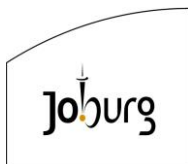
- (a) Pedestrian fences with diamond mesh, or tension fencing to the full height of the fence.
- (b) Security fences, either the veranda type with diamond mesh or tension fencing on the vertical portion and barbed wire on the overhang, or the vertical type with full height diamond mesh, tension fencing, or razer mesh, either with or without rolls of barbed-tape concertinas fitted as shown on the Drawings. The fences can also be fitted with "Flat Rap" concertinas.
- (c) Palisade fences (ten pales per section).
- (d) Stock fences, standard barbed wire type.

#### **PSVB 2 INTERPRETATIONS**

The following Specifications shall, inter alia, form part of the Contract Document:

- a. SANS 1200 A

Employer:		Contractor:	
Witness:		Witness:	



- b. SANS 1200 C
- c. SANS 1200 G
- d. The Particular Specification G02: Corrosion Protection.

### **PSVB 3 MATERIALS**

#### **PSVB 3.1 POSTS, STAYS, STANDARDS AND DROPPERS**

Posts, stays, standards and droppers shall be of the type and size indicated on the Drawings. Posts shall include gate posts, straining posts and corner posts.

Metal posts, stays, standards and droppers shall comply with the requirements of CKS 82 and SANS 280. "Acceptable" in CKS 82 means "acceptable to the Engineer".

Tubular posts shall be sealed at the top with caps and shall be fitted with base plates as shown on the Drawings.

Tubular posts, standards and stays shall be galvanized in accordance with SANS 763 Table 1 for type B1 articles. All rail sections, Y sections and metal droppers shall be provided with a protective coating of tar or other approved material.

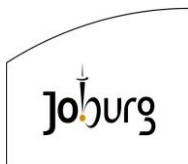
Timber posts, stays, standards and droppers shall comply with the requirements of SANS 457 and shall be creosote impregnated in accordance with SANS 05, with creosote complying with SANS 538 or SANS 539. All timber shall be straight and free from unsightly knots, splits and other imperfections.

Corner, gate and straining posts shall be suitably drilled for stay bolts or gate fittings as indicated on the Drawings.

#### **PSVB 3.2 BOLTS FOR STAYS**

Bolts shall be of mild steel and galvanized in accordance with SANS 763 Table 1 for type C articles. The length and diameter of the bolts shall be as shown on the Drawings. All the necessary bolts, together with nuts and washers, shall be supplied with each post.

Employer:		Contractor:	
Witness:		Witness:	



### PSVB 3.3 WIRE

All wire shall conform to the requirements of SANS 675 and shall be Class B galvanized, except where otherwise specified below.

#### (a) Barbed wire

Barbed wire shall be one of the following types:

- (i) High tensile grade, oval shaped, single strand wire,  
  
2,60 mm x 2,00 mm.
- (ii) Mild steel grade, double strand, uni directional twist wire, each strand  
2,50 mm in diameter.

Barbs shall be spaced at not more than 150 mm intervals.

#### (b) Smooth wire

Smooth wire shall be of the types specified below:

- (i) Straining wire shall be mild steel wire, 4,00 mm in diameter.
- (ii) Fencing wire shall be high tensile grade 2,24 mm diameter wire.
- (iii) Tying wire or binding wire shall be 2,50 mm diameter mild steel Class C galvanized wire for tying fencing wire to standards and droppers, and 1,60 mm diameter, mild steel Class C galvanized wire for tying wire mesh to fencing wire.

#### (c) Barbed tape concertinas and "Flat Rap"

Barbed tape concertinas and "Flat Rap" shall comply with the requirements for type A in CKS Specification 592 and shall consist of close coiled high tensile wire with a continuous strip of flat steel barbs (barbed tape) crimped to the wire along the entire length of the wire. The coils shall further be attached together

Employer:		Contractor:	
Witness:		Witness:	



by clips to give a concertina configuration when pulled apart. The coils shall be of the diameter as shown on the Drawings. Each concertina shall have a minimum of 55 coils, and the maximum effective length of open concertina, when pulled apart, shall depend on the diameter of the roll but shall not exceed 12 m.

The high tensile wire shall be Class B galvanised.

The barbed tape shall be made of cold rolled carbon steel galvanized to Class Z450.

The concertina clips shall be manufactured from steel strip galvanized to Class Z450.

**(d) Diamond mesh**

Diamond mesh (chain link fencing) shall comply with the requirements of SANS 1373. The width shall be as shown on the Drawings, and both edges shall be clinched.

The diameter of the wire shall be 2,5 mm and the mesh size shall be as shown on the Drawings.

The wire shall be Class B galvanized.

**(e) Razor mesh**

Razor mesh shall comply with the currently applicable SANS Specifications. The width shall be as shown on the drawing and the mesh shall be joined and fixed as specified by the manufacturer.

The diameter of the wire shall be not less than 2,5 mm and the razor barbs shall be needle sharp and approximately 23 x 19 mm in size.

It shall be a welded mesh with diamond sharp apertures, 150 mm wide by 300 mm high. The mesh shall be heavy duty galvanised.

Employer:		Contractor:	
Witness:		Witness:	



**(f) Tension fencing**

Pre assembled (welded) tension fencing shall be manufactured from wires complying with the requirements of SANS 675. The width shall be as shown on the Drawings with the wires having a minimum diameter of 2,24 mm and apertures between them not exceeding 0.01 m<sup>2</sup>. All wires shall be of a high tensile grade, and shall be Class B1 galvanized.

**PSVB 3.4 Gates**

Gates shall comply with the requirements of CKS 146 and shall be manufactured to the dimensions shown on the Drawings.

Gates shall be complete in every respect, and shall include hinges, bolts, nuts, washers and locking mechanisms as shown on the drawings.

**PSVB 3.5 Materials for Temporary Fences**

All new material for temporary fences shall be of the same quality as the material for new fences. Second hand material, whether available on Site or purchased, shall be submitted to the Employer's Agent for approval before use.

The protective galvanized coating on all second hand fencing wires shall be intact but may have a rusty appearance provided that the rust is superficial and does not impair the structural strength of the items.

**PSVB 3.6 MATERIALS FOR PALISADE FENCES**

**(a) Posts**

Posts shall be 3 m in overall length, the front edge shall be curved at 40 mm diameter curve tapering to the back to a thickness of 120 mm, the width of the post shall be 200 mm. Posts shall be slotted in positions suitable to take the horizontal load bearing rails. The top edge of the post shall be at an angle of approximately 26° dropping from back to front. The front and sides shall be off shutter finish and the back shall be floated smooth. Reinforcing to the posts shall be three 8 mm diameter mild steel bars.

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Witness:		Witness:	



Posts with a single internal security arm shall have a 80 mm x 80 mm x 450 mm long concrete veranda arm cast into the post, reinforced with two 8 mm diameter deformed bars. The concrete veranda arm shall have three 3 mm diameter holes to take the tie wires to secure the barbed wire to the veranda.

(b) Rails

Rails shall be 2,0 m long x 50 mm thick x 150 mm deep. The top edge shall be bevelled 10 mm from the front to back, the rails shall be reinforced with one 10 mm diameter deformed bar at the bottom and one 8 mm diameter bar at the top. The back, top and bottom edges shall be of shutter finish and the front to be floated smooth.

(c) Pales

The pales shall be 2.4 m long, curved at 40 mm diameter at the front tapering to 85 mm at the back with a depth of 140 mm minimum over the total length of the pale excepting the section where the fixing rail passes through the pale. The pales shall comply with Degree of Accuracy II as set out in sub-clauses 6.1 to 6.2 of SANS 1200G. Each pale shall have two cut outs for fixing the horizontal rails. Each pale shall be reinforced with two 5,6 mm diameter steel mild bars. The top edge of the pale shall be tapered at the same angle as the top of the posts. The front and sides shall be off shutter finish and the back shall be floated smooth. Pales shall be spaced at 200 mm centre to centre

(d) Ground Beans

Ground Beans consisting of 200mm x 200mm grade 15/20 concrete shall be cast below the fence with the top on the same level as the bottom of the pales.

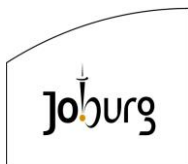
**PSVB 3.7 Concrete**

Concrete used for fencing shall comply with the requirements of SANS 1200G.

**PSVB 4 Plant**

Not applicable to this Section.

Employer:		Contractor:	
Witness:		Witness:	



## **PSVB 5 CONSTRUCTION**

### **PSVB 5.1 Clearing of Fence Line**

Strip clearing for the fence shall be carried out and paid for in accordance with SANS 1200C.

### **PSVB 5.2 Installing Posts and Standards**

Straining posts shall be erected at all ends, corners and bends in the line of fencing and at all junctions with other fences. Straining posts shall not be spaced further apart than shown on the Drawings. The height of the posts above the ground shall be such that the correct clearance between the lowest wire and the ground can be obtained.

Posts shall be accurately set in holes and where indicated, shall be provided with concrete bases to the dimensions shown on the Drawings.

Holes shall be dug to the full specified depth. Where, owing to the presence of rock, the holes cannot be excavated by hand or by pneumatic tools and the Contractor has to resort to the use of explosives, he will be paid separately for the drilling and blasting operations required.

Corner, gate, end and straining posts shall be braced by means of stays or anchors, as shown on the Drawings. Pipe stays shall be bolted to the posts.

Standards shall be firmly planted in the ground at the spacing shown on the Drawings or as directed by the Engineer. The spacing of standards between any two straining posts shall be uniform. In rock or hard material standards shall either be driven or set in holes drilled into the rock. The size of drilled holes shall be such that a tight fit is obtained. Care shall be taken not to buckle or damage the standards when driven. Where indicated, standards shall be provided with concrete bases to the dimensions shown on the Drawings.

All posts and standards shall be accurately aligned and set plumb. Where veranda-type security fencing is used, the posts and standards shall be planted with the overhang as shown on the Drawings and at right angles to the direction

Employer:		Contractor:	
Witness:		Witness:	



of the fence. After posts and standards have been firmly set in accordance with the foregoing requirements, the fencing wire shall be attached thereto as described below.

### **PSVB 5.3 Installing Wire and Tension Fencing**

All fencing wire shall be carefully stretched and hung without sag and with true alignment and care shall be taken not to stretch the wire so tightly as to cause breaking, to pull up straining posts, or to be easily damaged during veld fires.

Each strand of fencing wire shall be securely fastened in the correct position to each standard with galvanized binding wire. The binding wire for each horizontal fence wire shall pass through a hole or notch in the standard and the ends of the wire shall be wound at least four times around the fencing wire.

At the end, corner, straining and gate posts the fencing wire shall be securely wrapped twice around the post and secured against slipping by tying the end tightly around the wire by means of at least six snug, tight twists. In the case of high-tensile wire, two long windings must first be made before the six tight twists to prevent the wire from breaking at the first twist. Where smooth wire is used, the loose end shall be bent back and hooked into the opening between the fencing wire and the first winding.

Splices in the fencing wire will be permitted if made in the following manner with the use of a splice tool. The end of each wire at the splice shall be carried at least 75 mm past the splice tool and wrapped snugly around the other wire for not less than six complete turns, after which the two separate wire ends shall be wound in opposite directions. After the splice tool has been removed, the space left by it in the splice wire shall be closed by pulling together the wire ends. The unused ends of wire shall be cut close so as to leave a neat splice.

Tension fencing shall be installed according to the methods and with the special tools recommended by the manufacturer.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSVB 5.4 Installing Droppers**

Droppers shall be tied to each fence wire with binding wire in the required position to prevent vertical slipping. The spacing of droppers between any two standards shall be uniform and shall be at distances as shown on the Drawings. Droppers shall be suspended just clear of the ground.

#### **PSVB 5.5 Installing Diamond Mesh and Razor Mesh**

Where indicated on the Drawings, mesh shall be stretched against the fence and properly tied to the fencing wire. The mesh shall be secured by means of binding wire at 450 mm centres along the top and bottom wires and at 1 500 mm centres along each of the other fencing wires, unless shown otherwise on the Drawings. Recommendations by the manufacturer not mentioned here, must also be adhered to.

#### **PSVB 5.6 Installing Barbed-Tape Concertinas and "Flat Rap"**

Barbed-tape concertinas or "Flat Rap" shall be positioned on the fence as shown on the Drawings. The concertinas shall be fastened to the appropriate fencing wires at each standard as well as at 1,0 m maximum intervals between standards.

Rolls of barbed-tape concertinas shall be joined with binding wire at four points, spaced at equidistant intervals around the circumference of the loop. Joints shall be made to coincide with the positions of standards.

#### **PSVB 5.7 Closing Openings Under Fences**

At ditches, streams, drainage channels or other hollows where the fence cannot follow the general ground contour, the Contractor shall close the opening under the fence by means of horizontal barbed wires 150 mm apart and stretched between additional standards or straining posts as shown on the Drawings. The opening shall be covered with strips of mesh, fixed to the barbed wires where applicable.

Employer:		Contractor:	
Witness:		Witness:	



In the case of larger streams the opening below the lower fencing wire shall be closed by means of loose-hanging wire nets as shown on the Drawings. These mats shall be erected at streams only on the instructions of the Engineer.

#### **PSVB 5.8 Existing Fences**

Where a new fence joins an existing fence, whether in line or at an angle, the new fence shall be erected with a new straining post positioned at the junction with the existing fence.

Existing fences that are required to be taken down or moved to a new location shall be dismantled and shall either be re-erected to the same design as originally constructed, with such modifications as the Engineer may require, or shall be erected to one of the standards specified in PSVB 1.1 if so scheduled.

Material not required for re-erection or declared to be unsuitable for re-use shall be removed from the site in accordance with the Engineer's instructions.

In the case of existing fences that require moving, the Contractor shall, where possible, re-use all material found to be suitable for this purpose, and shall supply any such new materials as may be required for re-erecting the fence to the standards specified for new fences.

The Contractor shall take extreme care when straining used wire to avoid unnecessary breakage.

#### **PSVB 5.9 TEMPORARY FENCES**

At any time during the currency of the Contract, the Engineer may direct the Contractor to erect temporary fencing where necessary in order to prevent unauthorised access to the Works. Such fencing shall be of one of the types mentioned in Clause PSVB 1.1 and the type to be used shall be as scheduled.

Should material be available from fences that have been dismantled elsewhere on the Site, it shall be utilized, where possible, before additional new or second-hand material is acquired for completing the fence.

Employer:		Contractor:	
Witness:		Witness:	



The fencing shall be maintained in good order during construction operations, and on completion of the Works it shall be removed from the Site. Wherever practicable, the Engineer may instruct that permanent and not temporary fencing be erected before construction operations commence.

Payment for temporary fencing around the Contractor's camp shall be included in the amount tendered for the Contractor's establishment on Site as specified in SANS 1200 A.

#### **PSVB 5.10 Installing Gates**

Gates shall be installed at the positions indicated on the Drawings. The gates shall be hung on gate fittings in accordance with the details shown on the Drawings. Gates shall be so erected that they swing in a horizontal plane at right angles to the gate posts and clear of the ground in all positions. Double swing gates shall close to have gaps as shown on the Drawings.

#### **PSVB 5.11 Installing Palisade Fences**

Unless otherwise shown on the Drawings, foundations shall be 400 mm x 400 mm x 600 mm deep, posts shall be set at 2,0 m centres, rails shall be slotted into holes provided in the posts and then grouted with approved epoxy cement. The pales are then hung onto the rails and secured onto the rails with epoxy cement. The gap between the bottom of the rail and the cut out of the pale shall be caulked with 2:1 sand and cement mix.

No metal components shall be used for fixing rails to posts and for fixing pales to rails. (Refer to Drawings).

Grade 30/10 concrete shall be used for all precast components. Foundations and ground beans shall be in grade 15/20 concrete.

#### **PSVB 6 TOLERANCES**

The completed fences shall be plumb, taut, true to line and to the ground contour, and with all posts, standards and stays firmly set.

Employer:		Contractor:	
Witness:		Witness:	



The height of the lower fencing wire above the ground at posts and standards shall not vary by more than 25 mm from that shown on the Drawings. Other fencing wires shall not vary by more than 10 mm from their prescribed relative vertical positions.

Anchoring of a fence to structures shall be done as shown on the Drawings.

The Contractor shall, on completion of each section of fence, remove all cut offs and other loose wire or mesh so as to leave the fence with a neat and finished appearance.

Any cracked or damaged section of the palisade fencing shall be removed and replaced.

**PSVB 7 TESTING**

Not applicable to this Section.

**PSVB 8 MEASUREMENT AND PAYMENT**

**PSVB 8.1 Supply and Erection of New Fencing Material**

(a) Barbed wire (grade, size and type of wire indicated)

**Unit: Metre (m)**

(b) Smooth wire (grade and size indicated)

**Unit: Metre (m)**

(c) Barbed tape concertinas or "Flat Rap" (coil diameter indicated)

**Unit: Meter (m)**

The unit of measurement shall be the metre of each type of fencing wire and barbed tape concertinas measured between end posts. Binding wire and wire used for the bracing and anchoring of posts shall not be measured for payment.

(d) Diamond mesh (mesh height, mesh size indicated)

**Unit: Square metre (m<sup>2</sup>)**

Employer:		Contractor:	
Witness:		Witness:	



- (e) Razor mesh (height of fence and grade of galvanising stated)

**Unit: Square metre (m<sup>2</sup>)**

- (f) Tension fencing (proper description indicated)

**Unit: Square metre (m<sup>2</sup>)**

The unit of measurement shall be the square metre of mesh or tension fencing and the quantity shall be calculated on the prescribed width and the length between straining posts or gate posts or the length of strips for covering openings under fences, or the length used for the covering of gates.

- (g) Corner, end, straining and gate posts, including anchors (type, size and length indicated)

**Unit: Number (No)**

- (h) Ditto but with two stays

**Unit: Number (No)**

- (i) Supply, cast and finish 0.1m<sup>3</sup> concrete grade 10/20 footings for posts

**Unit: Number (No)**

- (j) Excavate holes for posts in rock (blasting)

**Unit: Number (No)**

- (k) Standards (length and type indicated)

**Unit: Number (No)**

- (l) Droppers (length and type indicated)

**Unit: Number (No)**

The unit of measurement shall be the number of posts, standards and droppers erected and holes blasted and filled with concrete in accordance with the maximum specified spacing or such lesser spacing as authorized by the Engineer.

The tendered rates shall include full compensation for binding wire, straining wire, bolts, washers and nuts and for the complete erection of the fence as specified and as shown on the Drawings. The tendered rate for posts shall

Employer:		Contractor:	
Witness:		Witness:	



make provision for the construction of the stays of the types shown on the Drawings.

The quantity of materials used shall be determined by measuring the quantities of individual items of material installed in the complete fence. No linear measure of completed fence shall be applicable.

#### **PSVB 8.2 New Gate**

- (a) Single leaf (size and type indicated) Unit: Number (No)
- (b) Double leaf (size and type indicated) Unit: Number (No)
- (c) Motorised Sliding Gate (size and type indicated) Unit: Number (No)

The unit of measurement shall be the number of new gates erected. A pair of gates shall be measured as one.

The tendered rate shall include full compensation for barrel bolts, tubular receivers, catches, chains, padlocks etc. and for the erection of the gates as specified and as shown on the Drawings. It shall not include compensation for any fencing wire or mesh required on the gate.

#### **PSVB 8.3 Moving of Existing Fences and Gates**

- (a) Fences:
  - (i) Pedestrian fences (full description indicated) Unit: Metre (m)
  - (ii) Security fences (full description indicated) Unit: Metre (m)
  - (iii) Stock fences (full description indicated) Unit: Metre (m)
  - (iv) Gates (full description indicated) Unit: Number (no)

The unit of measurement for moving existing fences shall be the metre of fence moved and the quantity shall be taken as the length of fence which is

Employer:		Contractor:	
Witness:		Witness:	



permanently re-erected where material available from fences that have been dismantled elsewhere is used. Additional new material used during the re-erection of existing fences shall be measured as set out under item PSVB 8.1. The unit of measurement for the moving of gates shall be the number of gates moved. A double-leaf gate shall be measured as one.

The tendered rate for each metre of existing fence moved, or for each existing gate moved, shall include full compensation for dismantling the old fence, coiling and stacking the material not suitable for reuse, moving all material, including posts and wire, re-erecting the fence or gate in the new position, and providing new binding, tying and straining wire. Additional new material used during the re-erection of the old fence shall be paid for under item PSVB 8.1.

The tendered rate for each gate moved shall include full compensation for taking down the gate and re-erecting it where required, including all new bolts, nuts and other accessories required, but excluding new gate posts, which will be measured and paid for under sub item PSVB 8.1(g).

#### **PSVB 8.4 Dismantling of Existing Fences**

- (i) Fencing (State type of fence and height) Unit: Metre (m)
- (ii) Gates (State type and size) Unit: Number (No)

The unit of measurement shall be the metre of existing fencing, and the number of existing gates taken down and dismantled on the instruction of the Engineer. The tendered rate shall include full compensation for taking down existing fences and gates, the coiling of wires, rolling netting into rolls, transporting the material to designated sites as specified.

#### **PSVB 8.5 Provision of Temporary Fencing**

- (a) Pedestrian (full description indicated) Unit: Metre (m)
- (b) Security (full description indicated) Unit: Metre (m)
- (c) Stock (full description indicated) Unit: Metre (m)

Employer:		Contractor:	
Witness:		Witness:	



(d) Gates (full description indicated) **Unit: Number (No)**

The unit of measurement shall be the metre of each type of temporary fence erected and the number of gates installed as instructed by the Engineer.

The tendered rate shall include full compensation for the provision of all labour, and new or suitable second-hand material, for the erection of the temporary fence and when no longer required, the dismantling and removal of such material from the Site or to any new position where required.

When second-hand material is obtained from existing fences for the erection of temporary fences, the material shall be transported to designated sites and stacked when the fence has been dismantled and the material is no longer required.

**PSVB 8.6 Ring Bolts for Anchoring Fencing to Structures**

(a) Ring bolts (length and diameter stated) **Unit: Number (No)**

The unit of measurement shall be the number of ring bolts supplied and fixed to the structure.

The tendered rate shall include full compensation for the supplying and fixing of ring bolts, of the type shown on the Drawings, to the structure, including where necessary, drilling holes, the grouting-in of ring bolts with epoxy resin, and for all incidentals.

**PSVB 8.7 Supply and Erection of Palisade Fences**

(a) Palisade fencing complete excluding barbed wire and taped concertinas **Unit: Metre (m)**

The tendered rates shall include full compensation for all excavations, concrete, formwork and the completed fence as indicated on the drawings (barbed wire and concertinas shall be measured and paid under items PSVB 8.1 (a) and (c).

Employer:		Contractor:	
Witness:		Witness:	



### PORTION 3: PARTICULARS OF REQUIRED MECHANICAL EQUIPMENT

This section defines the specifications for mechanical infrastructure to be installed as part of this contract. The Specifications for the scope of work under this Contract are grouped as:

Mechanical Project specifications:

- PSX1.1 - Trash Rake Screen
- PSX1.2 - Fine and Coarse Screens and Associated Equipment
- PSX1.3 - Grit Handling Equipment
- PSX1.4 - Bio-Reactor Equipment
- PSX1.5 - Clarifier Equipment
- PSX1.6 - Wash Water Filtering and Storage
- PSX1.7 - Lime Plant
- PSX1.8 - Macerator Pump Station
- PSX1.9 - Primary Sedimentation Tank Equipment
- PSX1.10 - Fermenter Equipment

Mechanical Particular specifications

- PSX2 - General mechanical engineering
- PSX3 - Operation and maintenance manuals
- PSX4 - Machine mounts
- PSX5 - Grid floors, guard rails and ladders
- PSX6 - Nuts, bolts and fastening sets
- PSX7 - Standard Specification for Fluid Control Equipment

The following Particular Specifications can be found in Volume 2 of this Tender:

- G01 - Colour coding
- G02 - Corrosion protection specification
- M01 - Mechanical Screens
- M02 - Mechanical Degritter Systems
- M03 - Mechanical Primary Sedimentation Tanks Equipment
- M05 - Mechanical Anaerobic and Anoxic mixing equipment
- M08 - Mechanical Gearboxes
- M09 - Mechanical Archimedean Screw Pumps
- M10 - Mechanical Secondary Clarifier Tanks Equipment
- M11 - Mechanical Fermentation Tanks Equipment

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

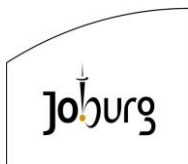


Volume 2A  
Part 3: Scope of Work

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M13		Mechanical Sludge Thickener Tanks Equipment
M16	-	Mechanical Conveyor Equipment
M17		Mechanical Actuator Equipment
M18		Mechanical Centrifugal pumps
M20	-	Mechanical Valves
M21	-	Mechanical Pressure pipework
M22	-	Mechanical hydrated lime handling, Storage, Feeding, Wetting and Dosing
M34	-	Mechanical Sluice/Channel Gates, Adjustable Weirs, Hand Stops and Stop Logs

Employer:		Contractor:	
Witness:		Witness:	



## **PSX1 MECHANICAL PROJECT SPECIFICATION**

The scope of this Contract is described in general terms under the appropriate headings in Section PS1. This section of the Specification provides details of the mechanical plant and equipment required to complete the installation.

Specific attention is drawn to the Mechanical Particular Specifications that are to be read together with this Mechanical Project Specification. This Project Specification supplements the Particular Specifications and should any requirement of the Project Specification conflict with any requirement of the Particular Specifications, the requirements of the Project Specifications shall prevail.

The prices tendered shall be deemed to cover everything necessary for the equipping and commissioning of the proposed new and refurbished plant, including pipework and appurtenances.

The work shall include, inter alia, preparation of drawings of the proposed new mechanical plant and equipment showing full details of the required plant, pump sets, pipework and valves, holding down arrangements, flexible couplings, and coupling guards, manufacture and factory testing of pumps, motors and accessories, delivery, handling and erection, testing in situ, commissioning, training and maintenance for a period of 12 months and everything necessary for the satisfactory operation of the installations and all related control equipment to the satisfaction of the Employer's Agent

### **PSX1.1. TRASH RAKE SCREEN**

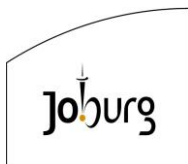
#### **- Drawing references**

The drawings listed below are bound in Volume 3 of the tender document.

18056-73-03-110 Mechanical Trash Screen - General Arrangement

18056-73-03-111 Mechanical Trash Screen 3D View, Plan & Sections

Employer:		Contractor:	
Witness:		Witness:	



- General requirements

The incoming wastewater flow from the main sewer to the Bushkoppie WwTW enters the works with a 4m wide channel and then split into two channels one to HoW Module 1 and one to HoW Module 2.

Due to the large outfall sewer large objects enters the Works which damage the mechanical equipment at the HoW. As the only available space to install a Trash Screen is in the main channel, only one Trash Screen will be installed upstream of the split to the two HoW Modules.

The installation shall comprise of one trash screens and one overhead rake cleaning mechanism. The cleaning mechanism will clean the trash screen and deposit the screenings into a skip positioned adjacent to the trash rake screening channel and as indicated on the drawings.

- Performance Requirements

a) Trash Rack Screen

The trash rake bar screen shall be front cleaned by the trash rake cleaning mechanism with stationary teeth/bars designed to penetrate the static bar field while descending from the overhead monorail mounted operating mechanism.

A wire rope operated gripper assembly shall close over the collected debris for transportation back to surface and monorailed to the designated discharge area into the screening skip.

The equipment shall be in compliance with all local codes and statutory regulations as required.

The Trash Rack screen shall be designed in accordance with the following design parameters and configuration requirements indicated on the drawings:

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

Volume 2A  
Part 3: Scope of Work



TRASH RAKE UNIT 4		
Description Unit	Unit	Value
Number of Monorail Traveling Gripper Screens:	No	1
Length of Monorail Track	m	±5
Number of bar racks:	No	1
Peak Flow per bar rack:	m <sup>3</sup> /sec	4.167
Channel Width:	mm	4000
Channel Depth:	mm	2550
Screen gab width:	mm	150
Screen bar rack inclination:	degrees	75
Downstream Liquid Level at Peak Flow:	mm	800

Materials of Construction

- All wetted parts shall be stainless steel type 304L.
- The gripper shall be stainless steel type 304L.
- The bar rack shall be stainless steel type 304L.
- The drum shall be stainless steel type 304L.
- The dollies shall be stainless steel type 304L.
- The wheels shall be stainless steel type 304L.
- Wet and Dry fasteners stainless steel type 316
- The monorail and support columns shall be type carbon steel hot dipped galvanized.

Equipment Design Features

**A. General**

1. Equipment shall be suitable for automatic (or manual by the operator) operation in raw sewage and shall be designed and arranged to remove trash, plastic bags, branches, tyres and other debris from

Employer:		Contractor:	
Witness:		Witness:	



- multiple bar screens, transport it to and discharge into the designated discharge area.
2. The Trash Rake System shall primarily consist of an overhead rail type track, a traversing carriage and a raking unit. The carriage shall travel along an overhead track until the desired section of the bar rack has been reached. The rake shall then be lowered to engage and penetrate the bar rack for debris removal to just above invert elevation. The rake shall then be closed, raised and debris transported to the designated discharge area.
  3. The overhead track shall be fabricated as I-beam, which is the track for the traversing dolleys and the support the festoon system. The track shall be supported by steel support columns located where shown on plan or as determined by the contractor to the approval of The Engineer.
  4. The rake carriage unit shall contain the traversing dolleys with motor(s), hoisting gear motor(s) and a hydraulic power unit. Two dolleys mounted on top of the carriage shall traverse the carriage. The hoisting system shall consist of spirally grooved rope drums mounted on a common shaft within the carriage to raise and lower the rake. A geared motor unit shall drive the hoist shaft with brake. Electrical power to the carriage shall be supplied by a festooning system.
  5. Gripper Trash Rake shall be designed to be operated both manually by an operator and automatically without an operator. The rake shall be lowered to engage and penetrate the bar rack for debris removal to just above invert elevation. The rake shall then be closed, raised and debris discharged to the appropriate discharge area. Trash rack cleaning must be possible up to the maximum clogged trash rack head differential at maximum flow.
  6. The rake cleaner frame shall be rigid and dimensioned to carry the load of the hoist machinery and the maximum rake load.
  7. The rake cleaning frame shall contain the electrically operated hoisting and lowering gear motor. The hoisting system shall consist of spirally

Employer:		Contractor:	
Witness:		Witness:	



grooved rope drums mounted on a common shaft within the carriage to raise and lower the rake. The hoist shaft shall be driven by a geared motor unit with brake.

8. The hoisting gear shall incorporate a power monitor to protect the motor if the rake becomes jammed by an obstruction on rising. A “slack rope” device shall be provided to operate a cut-out to stop the motor should the rake jam when lowering. Lowering the rake shall be accomplished by running the hoist motor in reverse, and limit switches shall be provided to limit upward and downward travel. An electromechanical brake shall be incorporated in the hoist gear to prevent movement of the rake immediately should the hoist motor stop or electricity supply fails.
9. The rake grab shall be supported by wire ropes and shall consist of a series of teeth designed to engage with the bar rack and shall be opened and closed by hydraulic cylinders. The rake head shall be prevented from excessive lateral swaying when traversing motion stops by a swing restrictor.

#### **B. Screen Construction**

1. The bar screen is to be supplied by the same supplier as the gripper rake assembly. The screen bars, framework support and anchor bolts shall be constructed of type 316 stainless steel. The bar screen and framework support shall be designed to withstand forces at peak flow with the screen 100% blinded at the water elevations shown on the drawings. The screen bar spacing shall be 100mm.
2. The bar rack screen shall be manufactured from the bar sections with the longer dimension parallel to the flow. Bars shall be offset from the supports by a length sufficient to allow for full penetration of the rake teeth. Bars welded or directly connected to the horizontal supports shall not be acceptable.

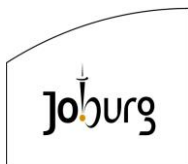
Employer:		Contractor:	
Witness:		Witness:	



### ***C. Screen Rake and Gripper Assembly***

1. The gripper shall be manufactured from stainless steel type 304L with teeth spaced to match the openings in the bar screens. The gripper shall operate by being traversed over the required section of the bar screen during a cleaning cycle. The gripper shall be in the open position when being lowered.
2. The rake rear teeth shall normally engage with the bar screen above the maximum high-water elevation pushing the debris to the channel invert. Teeth shall automatically engage and self-centre between the bars during the descent.
3. The rake and gripper assembly will ride on non-metallic, non-lubricated wheels and guide the rake along guide channels while ascending and descending.
4. The rake rear teeth shall be capable of passing all the way through the bar screen without interference from the bar screen horizontal supports. The gripper shall continue to be lowered until it reaches the invert elevation (or an immobile object). The gripper mechanism shall close, trapping the collected debris for removal.
5. The gripper shall be closed under hydraulic power by controls above deck level when the invert has been reached (or at any time under manual control). The hydraulic cylinders shall be suitable for submerged service.
6. When closing, the upstream teeth of the gripper shall be rotated towards the rear teeth and close in conjunction with the rear teeth to remove and lift objects or debris build up wider than the bar screen opening and within the lifting capacity of the hoist.
7. With the gripper in the closed position, the front teeth shall form an “overbite” past the rear teeth. During the hoist raising operation, the “overbite” shall penetrate the screen bars to prevent heavy build-up of

Employer:		Contractor:	
Witness:		Witness:	



debris. Designs employing pivoting rear or lower teeth shall not be allowed.

**D. Dolley Assembly**

1. Dolley assembly shall contain all the necessary traversing and hoisting equipment to support and move the Rake and Gripper assembly. This includes the traversing drive and wheels, hydraulic power unit, hoisting drive, hoist drums, hoist cable, hydraulic hoses with spring tensioned hose reel, slack cable tension roller with limit switches, hoist raising and lowering limit sensors, over-travel limit switches and position sensors for automatic operation.
2. Each dolley shall include four wheels. Two of the wheels shall be driven by rack-wheel, fitted to the gearbox on one side. Each shall be independently driven and shall have their own gearbox and brake motor. The dolley drives shall be controlled via VSD's.
3. The hydraulic power pack shall provide for the operation of the hydraulic cylinders which open/close the gripper. Designs which utilize mechanical closing rakes shall not be allowed. Fluid power shall be transferred to cylinders through high strength hoses which are to be wound on spring tensioned drum(s) operating in sequence with hoisting drums. The hoses shall be located downstream of the hoisting cables for protection. The hydraulic fluid shall be biodegradable for environmental concerns.
4. Electrical power to the dolley unit shall be supplied by a trailing cable which contains both power and control leads supported on cable wagons inside the track or other festooning method acceptable to the gripper.

**E. Support Structure**

1. The track (monorail) support columns shall be manufactured from carbon steel. The columns shall be adequately sized to support the track, spaced as indicated on the drawings and sized to withstand the conditions that will be experienced during operation. The columns

Employer:		Contractor:	
Witness:		Witness:	



shall be “U” shaped or “L” shaped with heavy flanged feet for fixing to the deck level or other location. The feet shall be anchored via properly sized anchor bolts supplied by the grab rake supplier and grouted in place by the contractor.

2. Steel supports columns and monorail shall be hot dipped galvanized after fabrication and welding.

**F. Guards**

1. The dolly shall be enclosed by stainless steel type 304L covers.

**PSX1.2. FINE AND COARSE SCREENS AND ASSOCIATED EQUIPMENT**

Drawing references

The drawings listed below are bound in Volume 3 of the tender document.

18056-73-03-105 Coarse Screens Layout & Sections - Refurbishment

18056-73-03-107 Fine Screens Layout & Sections - Refurbishment

Scope of Work

The scope of work for the coarse and fine screening areas of head of works Module 1 is the conditional assessment, refurbishment, design, fabrication, supply, delivery, transport, handling (double handling if required), storage, erection, installation, testing and commissioning of the plant and its ancillary equipment. The plant shall include, but not be limited to, the following equipment:

- Two mechanical front raked coarse screens,
- Four mechanical front raked fine screens,
- Four mechanical washer compactors,
- Two hydro conveyors,
- Two swivel screw conveyors,
- Two automated winch systems for bin dollies

A conditional assessment of both the coarse and fine screens, including the submission of a conditional assessment report to the Employer’s Agent is required.

Employer:		Contractor:	
Witness:		Witness:	



The refurbishment/replacement of the coarse and fine screens will be dependent on the recommendations in the conditional assessment report and cost implications thereof.

### Particular Specifications

This specification must be read in conjunction with the Particular Specification M01: Volume M01: Mechanical Screens and with Volume G02: Particular Specification for Corrosion Protection.

### Front Raked Coarse Screens

The coarse screens are situated downstream of the trash screen and will be responsible to remove large items that are not removed by the trash screen. The coarse screens shall have an aperture of 12mm.

The screening installation will comprise of two mechanically front raked screens mounted in 2000 mm wide channels. Each screen shall be capable of handling a maximum flow of 1042ℓ/s. The channel is 2300 mm deep. The layout and details of the screening channel are shown on Drawing 18056-73-03-102 Z00.

The mechanical screen shall comprise of 12.0 mm wide bars with the clear opening between bars not exceeding 12.0 mm. The screen bars shall be tapered. The screens and all associated equipment supplied under this section shall be capable of handling a screening content in the incoming sludge of 0.3m<sup>3</sup>/Mℓ and a fats content of 15%.

The condition of the existing coarse screens shall be assessed by the Contractor. Thereafter, a conditional assessment report shall be submitted to the Employer's Agent. The Employer's Agent will decide on the replacement/refurbishment of the coarse screens.

### Front Raked Fine Screens

The fine screens are situated downstream of the coarse screens and the vortex degritters and will be responsible for removing any items that are not captured by the coarse screens. The fine screens shall have an aperture of 6mm.

Employer:		Contractor:	
Witness:		Witness:	



The screening installation will comprise of four mechanically front raked fine screens mounted in a 3250 mm wide channel. Each screen shall be capable of handling a maximum flow of 694ℓ/s. The channel is 1520 mm deep. The layout and details of the screening channel are shown on Drawing 18056-73-03-104 Z01.

The mechanical screen shall comprise of 8.0 mm thick bars with the clear opening between bars not exceeding 6.0 mm. The screen bars shall be tapered. The screens and all associated equipment supplied under this section shall be capable of handling a screening content in the incoming sludge of 0.3m<sup>3</sup>/Mℓ and a fats content of 15%.

The condition of the existing fine screens shall be assessed by the Contractor. Thereafter, a conditional assessment report shall be submitted to the Employer's Agent. The Employer's Agent will decide on the replacement/refurbishment of the fine screens.

#### Hydro Conveyor

The existing screenings screw conveyors at the coarse and fine screens that transfers the screenings to the Screenings Compactors, must be replaced with Hydro Conveyors.

The layout of the hydro conveyors is indicated on the tender drawings.

The detailed design of the hydro conveyor will be prepared by the contractor including the support legs which shall be submitted to the Engineer for approval prior to manufacture.

The hydro conveyor shall be designed to handle the maximum loading as shown in the following table;

Coarse screens		
Hydro-conveyor Max Loading		
Screenings	m <sup>3</sup> /hr	1.01
Wash water	m <sup>3</sup> /hr	28.80
Total screenings and wash water	m <sup>3</sup> /hr	29.81

Employer:		Contractor:	
Witness:		Witness:	



The screenings hydro conveyor will be manufactured from stainless steel type 304 and will have an open top, straight sides and a curved bottom (flat bottom conveyor will not be acceptable) to facilitate moving of the screenings.

The hydro conveyor will incorporate an electric actuated swing gate for isolating the opening to the standby washer compactor while the entrance to the duty washer compactor unit is open to allow the screenings to only flow into the duty washer compactor.

### Washer Compactor

The existing compactor at the coarse screens must be replaced with two washer compactors, one duty and one standby. The two compactors at the fine screens must be replaced with two washer compactors and the operation must be altered to only have one compactor operating at a given time, therefore also one duty and one standby.

The washer compactors at the fine and coarse screens, must be sized to accept and process all the coarse or fine screenings at any given time, therefore duty standby and not duty assist.

The estimated design loading for the washing dewatering compactors is detailed in the following table;

Coarse Screens		
Primary screen compactor Max Loading		
Screenings	m <sup>3</sup> /hr	1.01
Wash water	m <sup>3</sup> /hr	28.80
Total screenings and wash water	m <sup>3</sup> /hr	29.81

Washed, dewatered and compacted screenings will be discharge from the washer/compactor chute into the trough of the Swivel Screw Conveyor which will transfer the screenings into the duty waste on an automated dolly.

Wash water for the screenings hydro conveyor and the screenings washing dewatering compactor will be filtered final effluent.

Employer:		Contractor:	
Witness:		Witness:	



The wash water outlet from the screenings washing dewatering compacter shall be returned to the inlet works up-stream of the screens

#### Swivel Conveyor

The existing swivel inclined conveyors that transfer waste into the waste bins at the fine and coarse screens shall be replaced by the Contractor. The washer compactor shall convey waste to the swivel conveyor which will then dispose the waste via a screw into the various waste bins. Swivel conveyors are required at Module 1 fine and coarse screens.

The swivel inclined conveyor shall be fixed to the concrete floor at the centre of the waste bins and shall be able to rotate with one support at the centre point and the other support moving on a set path from the first to the last waste bin, all controlled by means of an electric motor with push button control.

#### Motorised Bin Dolleys

The waste bins shall be placed on dolleys running on train rails with a motorized winch system with stainless steel cables.

A one Bin dolly system shall be implemented for handling of the screenings.

Each dolly shall be driven by an electrical geared motor fitted with a clutch type system to disengage the drive in the event of a motor / gearbox failure.

Power to the geared motor unit mounted on the dolly will be via a cable reeling drum.

The dolleys will be fixed onto rails such that only linear motion perpendicular to the screeni

ngs washer compactor will be allowed.

If there is a motor / gearbox failure the dolly shall be operated via a hand wheel which will also have a clutch system so it can be disengaged when being operated via the motor/geared unit and then engaged if operation is required to be manually.

The activation and positioning of the skip/dolly will be initiated by the operator via a localized on/off station for each dolly.

The position of the skip/dolly will be monitored on the SCADA via proximity switches.

Employer:		Contractor:	
Witness:		Witness:	



The full and empty skips shall be removed, replaced from the dolleys using a tractor /trailer for onsite storage for final offsite disposal by the JW services provider.

The detailed design of the dolleys, rails and trailer to be the responsibility of the contract and shall be submitted to The Engineer for approval prior to manufacture.

The basis of design shall take into consideration the following;

- Dolley shall be robust enough to withstand the maximum load from the skip which estimated to be 16000 kg
- Dolley shall be robust enough to withstand the removing of full skips and replace empty skips on the dolley by the tractor/trailer arrangement.
- Rails shall be light duty rail tracks having a minimum mass 15.0 kg/m
- Manual operation of the dolley design shall not require more than a force of 100 Newton on the hand wheel when the operating with a fully skip of 16000 kg.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Dismantle and remove (to Contractor's workshop off site), Inspect and Conduct conditional assessment of the existing coarse, fine screens, and the sluice gates.
- Dismantle and remove of the existing coarse screenings screw conveyors and bin dolley motors and cabling and deliver to the client storage area
- Dismantle and remove of the existing fine screenings screw conveyors and bin dolley motors and cabling and deliver to the client storage area
- Design, Supply, Deliver to site, Install, Commission and Test of two new coarse screens, hydro conveyor, two washer screenings compactor, screw conveyors and motorized bin dolley system all according to the specification
- Design, Supply, Deliver to site, Install, Commission and Test of four new fine screens, hydro conveyor, two washer screenings compactor, screw conveyors and motorized bin dolley system all according to the specification
- Design, Supply, Deliver to site, Install, Commission and Test of Trash Screen Complete all according to the specification

Employer:		Contractor:	
Witness:		Witness:	



- Design, Supply, Deliver to site, Install, Commission and Test of Modulating Actuator on existing sluice gates Complete all according to the specification.

### PSX1.3. GRIT REMOVAL AND GRITHANDLING

#### - General

There are four vortex degritters downstream of the coarse screens where the flow is equally divided to each degritter. Air lift pumping was installed previously with air air blowers installed in the blower room. The blower room currently supply air to both Module 1 and Module 2 HoW units.

#### - Reference Drawings

18056-73-03-106-T00 Vortex Degritters Layout and Sections

18056-73-03-113-T00 Module 1 Blower House Layout and Sections

18056-73-03-114-T00 Module 1 Compressor Room Layout and Sections

46100563-WSP-DR-CI-PID03\_T0-GRIT REMOVAL-MOD 1

46100563-WSP-DR-CI-PID04\_T0-GRIT REMOVAL-MOD 2

#### Particular Specifications

This specification must be read in conjunction with the Particular Specification M02 - Mechanical Degritter System and with Volume G02: Particular Specification for Corrosion Protection.

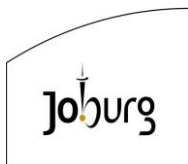
#### Scope

The scope of work for mechanical equipment at the grit handling at Module 1 HoW is the design, supply, delivery, transport, handling (double handling if required), storage, erection, installation (including replacing of existing equipment), commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period for:

##### Module 1:

- 8 off new Air Blowers in the existing Blower Room,
- Air supply piping from new Blowers to four degritters,
- 2 off new Compressors,

Employer:		Contractor:	
Witness:		Witness:	



- Grit slurry piping from four degritters to classifiers division channel,
- Classifier division channel with actuated swing gate valve,
- Two off new washer classifiers,
- Swivel screw conveyor with grit collection hopper and delivery chute,
- Four off waste bin dolleys on a motorised winch system, and
- Refurbishment of eight off existing sluice gates at degritters.

#### Module 2:

- 8 off Air Blowers in the new Module 2 Blower Building,
- Air supply piping from new Blowers to four degritters,
- 2 off new Compressors and an Air Receiver in the new Module 2 Blower Building,
- Grit slurry piping from four degritters to classifiers division channel,
- Classifier division channel with actuated swing gate valve,
- Two off new washer classifiers,
- Swivel screw conveyor with grit collection hopper and delivery chute,
- Three off waste bin dolleys on a motorised winch system, and
- Refurbishment of eight off existing sluice gates at degritters.

#### Air Lift Pumps

##### Module 1:

The screened sewage is equally split between four Vortex Type Degritters. The maximum flow to each degritter will be 694 l/s.

The Air Blowers for the Air Lift Pumping of the grit slurry from the Vortex Degritter sump to the Grit Classifiers, must be sized for a minimum submergence of 3.6m and a maximum lift of 4.3m. The maximum length of the air pipe from the blowers to the degritters is  $\pm 90\text{m}$ .

##### Module 2:

Employer:		Contractor:	
Witness:		Witness:	



The screened sewage is equally split between four Vortex Type Degritters. The maximum flow to each degritter will be 694 l/s.

The Air Blowers for the Air Lift Pumping of the grit slurry from the Vortex Degritter sump to the Grit Classifiers, must be sized for a minimum submergence of 4.07m and a maximum lift of 4.53m. The maximum length of the air pipe from the blowers to the degritters is  $\pm 60$ m.

#### Piping:

The tenderer is to size the grit transfer pipework to suit his design; however the velocity in the pipe should not be less than 2 m/sec to maintain solids in suspension or greater than 3 m/sec to limit wear by erosion of the pipe.

Fluidising of the grit prior to degritting by the air lift pump will be done by using pressurised wash water from the booster pumps at the wash water tank.

#### Washer Classifiers

The Classifiers must be the washer type as the discharged grit must have a maximum moisture content of 40% as required by landfill sites. The Classifiers shall operate on a one duty and one standby operation and each classifier shall be capable of handling with ease a maximum grit slurry inflow of 25 l/s when more than one air lift pump is in operation.

An electrical actuated swing gate must be installed on the grit slurry piping to direct the flow to a Grit Classifier. The overflow from the grit classifier must return the flow to the main incoming channel.

#### Motorised Bin Dolleys

The waste bins shall be placed on dolleys running on train rails with a motorized winch system with stainless steel cables.

A one Bin dolley system shall be implemented for handling of the grit from the grit classifiers.

Each dolley shall be driven by an electrical geared motor fitted with a clutch type system to disengage the drive in the event of a motor / gearbox failure.

Power to the geared motor unit mounted on the dolley will be via a cable reeling drum.

Employer:		Contractor:	
Witness:		Witness:	



The dolleys will be fixed onto rails such that only linear motion perpendicular to the grit classifiers will be allowed.

If there is a motor / gearbox failure the drolley shall be operated via a hand wheel which will also have a clutch system so it can be disengaged when being operated via the motor/geared unit and then engaged if operation is required to be manually.

The activation and positioning of the skip/dolley will be initiated by the operator via a localized on/off station for each drolley.

The position of the skip/dolley will be monitored on the SCADA via proximity switches.

The full and empty skips shall be removed, replaced from the dolleys using a tractor /trailer for onsite storage for final offsite disposal by the JW services provider.

The detailed design of the dolleys, rails and trailer to be the responsibility of the contract and shall be submitted to The Engineer for approval prior to manufacture.

The basis of design shall take into consideration the following;

- Drolley shall be robust enough to withstand the maximum load from the skip which estimated to be 16000 kg
- Drolley shall be robust enough to withstand the removing of full skips and replace empty skips on the drolley by the tractor/trailer arrangement.
- Rails shall be light duty rail tracks having a minimum mass 15.0 kg/m
- Manual operation of the drolley design shall not require more than a force of 100 Newton on the hand wheel when the operating with a fully skip of 16000 kg.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of the degritters
- Dismantle and remove of the existing blowers and piping in the HoW Blower House and deliver to the client storage area
- Dismantle and remove of the existing grit classifiers and piping at Module 1 HoW and deliver to the client storage area

Employer:		Contractor:	
Witness:		Witness:	



- Dismantle and remove of the existing grit classifiers and piping at Module 2 HoW and deliver to the client storage area
- Dismantle and remove of the existing grit conveyors and bin dolley cabling at Module 1 HoW and deliver to the client storage area
- Dismantle and remove of the existing grit conveyors and bin dolley cabling at Module 2 HoW and deliver to the client storage area
- Design, Supply, Delivery to site of new blowers for air lift pumping, piping, valves and accessories at Module 1 HoW according to the specification
- Installation and Commissioning of new blowers for air lift pumping, piping valves and accessories at Module 1 HoW according to the specification
- Design, Supply, Delivery to site of new blowers for air lift pumping, piping, valves and accessories at Module 2 HoW according to the specification
- Installation and Commissioning of new blowers for air lift pumping, piping valves and accessories at Module 2 HoW according to the specification
- Dismantle and remove (to Contractor's workshop off site), Inspect and Conduct conditional assessment of the eight manual operated sluice gates at the Vortex Degritters at Module 1 HoW
- Refurbish, deliver to site, install and commission of eight sluice gates at the Vortex Degritters at Module 1 HoW.

#### **PSX1.4. BIO-REACTOR EQUIPMENT**

##### General

The mixers at the existing four Bio-Reactor Units require to be refurbished or replaced. Each Bio-Reactor has a Return Activated Sludge Pump Station equipped with screw pumps where the bottom bearings of the screws require to be replaced.

##### Reference Drawings

18056-73-05-100 Bio Reactor 3D - Refurbishment

18056-73-05-101 Bio Reactor Floor Plan - Refurbishment

Employer:		Contractor:	
Witness:		Witness:	



18056-73-05-102 Bio Reactor Plan & Platforms - Refurbishment

Scope

a. Mixers

The scope of work for the mixers is the design, supply, delivery, transport, handling (double handling if required), storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period for:

- 4 off Anaerobic Basin No. 1 Mixers complete including motors, gearboxes, couplings, baseplates, safety guards, hold-down bolts etc.
- 4 off Anaerobic Basin No. 2 Mixers complete including motors, gearboxes, couplings, baseplates, safety guards, hold-down bolts etc.
- 8 off Anoxic Basin Mixers complete including motors, gearboxes, couplings, baseplates, safety guards, hold-down bolts etc.

The scope of work of the mixers will also include:

- Removal and placing into storage on site of the 16 no. existing mixers.

b. Screw Pump Bearings

The scope for the replacements of the 12 off bearings include the following:

- emptying of sump at bottom of each screw
- removal of the existing bearings
- installation of the new sealed type (ECO) bearings

Measurement and Payment

The tenderer must allow in his rates for the following:

- Disconnecting, dismantling and removal of the Mixers to be taken to the tenderer's workshop for inspection and refurbishment
- Storing of mechanical equipment at tenderer's workshop

Employer:		Contractor:	
Witness:		Witness:	



- Transporting of mechanical equipment back to site for installation or client's storage
- Installation and commissioning of refurbished mixers
- Design, Supply, Delivery to site of new mixers according to the specification
- Installation and Commissioning of new mixers according to the specification
- Replacing of the existing lower bearings at the Screw Pumps including all work involved with it as specified

#### **PSX1.5. CLARIFIER EQUIPMENT**

##### General

The mechanical equipment of all the twelve number Clarifiers requires refurbishment or replacement.

##### Reference Drawings

18056-73-04-100 Secondary Clarifier General Arrangement

18056-73-04-101 Secondary Clarifier 3D View

18056-73-04-102 Secondary Clarifier Plan & Section - As Built

18056-73-04-103 Secondary Clarifier Plan & Section - Refurbishment

##### Particular Specifications

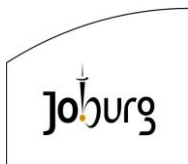
This specification shall be read in conjunction with the Particular Specification M10 - Mechanical Secondary Clarifier Tanks Equipment.

##### Particular Specification of Secondary Clarifier Tank Equipment

The mixed liquor outflow from the Bio-Reactor will flow to the Clarifier Division Box where it will be split between the three Secondary Clarifiers.

The existing mechanical equipment of the Secondary Clarifiers need to be refurbished or replaced.

Employer:		Contractor:	
Witness:		Witness:	



The Mechanical Equipment for the Secondary Clarifier Tanks is to suit an internal tank diameter of 30m and a side wall depth of 4.5m as detail in the above referenced drawings.

The tanks have a full bridge which only need to be refurbished.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of the tanks
- Dismantling and removal of the Bridge, Scum and Sludge Scraper system to be taken to the tenderer's workshop for inspection and refurbishment
- Refurbishment of the bridge
- Refurbishment of the scum discharge knife gate valves
- Storing of mechanical equipment at tenderer's workshop
- Transporting of mechanical equipment back to site for installation or client's storage
- Installation and commissioning of refurbished equipment
- Design, Supply, Delivery to site of new mechanical equipment according to the specification
- Installation and
- Commissioning of new mechanical equipment according to the specification

### **PSX1.6. WASH WATER FILTERING AND STORAGE**

#### **PSX1.6.1 EXISTING WASH WATER PUMP STATION**

##### **- General**

The Existing Wash Water Pump Station has been designed to filter the final effluent to be used as wash water at the HoW and was commissioned in 2000. The Sand Filters has therefore reached the end of their life and will have to be replaced with new Sand Filters.

Employer:		Contractor:	
Witness:		Witness:	



- Reference Drawings

18056-73-07-100 Wash Water Pump Station Plan - As Built

18056-73-07-101 Wash Water Pump Station Sections - As Built

18056-73-07-102 Wash Water Pump Station Plan - Refurbishment

18056-73-07-103 Wash Water Pump Station Sections – Refurbishment

46100563-WSP-DR-CI-PID08\_T0-EX WASH WATER PS

Reference must also be made to the drawing list in Volume 1 of the tender documents.

- Sand Filters

The existing four 1.8m diameter Sand Filters shall be replaced with new Sand Filters capable of filtering a total flow of 30 l/s. The filters must be filled with dual media sand and with an anthracite layer.

The filter body shall be high performance reinforced polyester with fibreglass with top lid of 400mm diameter and side manhole of 400mm diameter. The filters shall be fitted with collector arms and diffusers made from plasticised uPVC and polypropylene resistant to salt water. The filters shall also have a manual air relief valve and water purge, sand dump port and view glass, inlet and outlet pressure gauges for differential pressure indication.

The existing filter booster pumps must be replaced with new pumps and interconnecting pipework including control valves to operate as one duty and one standby with a flow of 33 l/s at a total head of 17.3m. The pumps must withdraw the effluent from the sump outside the building which is fed from the final effluent channel.

The filtered water must be transferred to the new storage tank outside the building.

- Air Blowers

The existing Air Blowers must be replaced with new blowers (one duty and one standby) required for the backwashing of the Sand Filters.

- Filtered Water Tank

The existing 65 000 liter filtered water tank outside the building must be replaced with a new 125 000 liter galvanized steel tank.

Employer:		Contractor:	
Witness:		Witness:	



- Wash Water Transfer Pumps

The existing three wash water transfer pumps (two duty and one standby) must be replaced with three new wash water pumps (one duty and two standby) to transfer the water in the filtered water tank outside the Wash Water Pump station to the new Wash Water Tank at the Head of Works.

The pumps will be installed with flooded suction but must be able to operate between tank full and tank empty but with a suction pipe length of  $\pm 10\text{m}$ . The duty of each pump is to deliver a flow of  $30\text{l/s}$  at a total head of  $59\text{m}$ .

- Sump Pump

The existing Sump Pump (Floor Drainage Pump) must be replaced with a new submersible pump with a duty of  $3\text{ l/s}$  at a total head of  $5\text{m}$ .

- HoW Wash Water Booster Pumps

Two sets of two pumps each must be installed at the new Wash Water Tank at the HoW. One set will supply pressurised wash water to Module 1 and one to Module 2. Both sets shall operate as one duty and one standby.

Each pump shall have a duty of  $15\text{ l/s}$  at a total head of  $76\text{m}$ . Each pump set shall have a pressure vessel to avoid the pumps from too frequent stop /starts when valves on the system are opening and closing.

- Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of the existing Wash Water Tank
- Dismantling of tank and place panels in client's storage area
- Supply, Delivery to site, Installation and Commissioning of new Filtered Water Tank at the Wash Water Pump Station
- Supply, Delivery to site, Installation and Commissioning of new Wash Water Tank at the Head of Works
- Dismantling and removal of the existing filters, pumps, blowers and piping to the client's storage area
- Design, Supply, Delivery to site of new sand filters, booster pumps, blowers, piping and valves according to the specification

Employer:		Contractor:	
Witness:		Witness:	



- Installation and Commissioning of new sand filters, booster pumps, blowers, piping and valves according to the specification
- Supply, Delivery to site, Installation and Commissioning of new Filtered Water pumps, piping and valves at the Wash Water Pump Station
- Supply, Delivery to site, Installation and Commissioning of new Sump Pump and piping at the Wash Water Pump Station
- Design, Supply, Delivery to site of two sets of HoW Wash Water booster pumps with pressure vessels, interconnecting piping and valves according to the specification
- Installation and Commissioning of two sets of HoW Wash Water booster pumps with pressure vessels , interconnecting piping and valves according to the specification

#### **PSX1.6.2 NEW WASH WATER FILTER STATION**

##### General

A new Wash Water Filter Station will be constructed to house sand filters to filter the final effluent to be used as wash water at the Sludge Dewatering Building.

##### Reference Drawings

18056-73-07-105 New Wash Water Filter Station 3D Views

18056-73-07-106 New Wash Water Filter Station Elevations

18056-73-07-107 New Wash Water Filter Station Layout & Sections

18056-73-07-108 New Wash Water Filter Station Roof Layout

46100563-WSP-DR-CI-PID07\_T0-WASH WATER PS

Reference must also be made to the drawing list in Volume 1 of the tender documents.

##### Sand Filters

Four new 2.4m diameter Sand Filters shall be installed in the newly constructed Wash Water Filter Station capable of filtering a total flow of 60 l/s. Each filter must be filled with dual media sand and with an anthracite layer.

Two new filter booster pumps shall be installed to operate as one duty and one standby with a flow of 64 l/s at a total head of 17.3m. The pumps shall withdraw

Employer:		Contractor:	
Witness:		Witness:	



the effluent from the sump outside the building which is fed from the final effluent channel.

The filtered water shall be transferred to the sump outside the existing Final Effluent Pump Station which is  $\pm 10\text{m}$  away.

#### Air Blowers

Two new Air Blowers shall be installed (one duty and one standby) required for the backwashing of the Sand Filters.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Design, Supply, Delivery to site of new sand filters, pumps blowers and piping according to the specification
- Installation and Commissioning of new sand filters, pumps blowers and piping according to the specification

### **PSX1.7. LIME PLANT**

#### General

The Lime Plant was commissioned in 2013 but has experienced some problems lately which requires attention. The Lime make-up needs to be improved with larger make-up tanks therefore the Silo needs to be relocated.

The Lime Clarifiers were previously used as WAS Thickeners and have lately experienced failure of the floor scrapers therefore refurbishment of the mechanical equipment is therefore required.

#### Reference Drawings

18056-73-11-100 General Arrangement

18056-73-11-101 Layout of New Lime Silo - Dosing Installation

18056-73-11-102 Lime Clarifier Layout & Section - As Built

18056-73-11-103 Lime Clarifier Layout & Sections - Refurbishment

46100563-WSP-DR-CI-PID06\_T0-LIME DOSING

Employer:		Contractor:	
Witness:		Witness:	



Reference must also be made to the drawing list in Volume 1 of the tender documents.

#### Particular Specifications

This specification shall be read in conjunction with the Particular Specification M22 Mechanical hydrated lime handling, Storage, Feeding, Wetting and Dosing equipment and M13 Mechanical Sludge Thickener Equipment.

#### Particular Specification of Lime Plant Equipment

##### a. Lime Dosing Flash Mixer

One axial flow flash mixer is required in the Lime Flash Mixing tank. The details of the mixing tank are shown on drawing 10261-70-7001. The volume of the chamber is 35 m<sup>3</sup> with a water depth of 2,150 mm and the distance from the top of the platform to the top of the floor is 2,800 mm.

One vertical shaft mixer shall be installed in the feed chamber upstream of the lime reaction tanks. The ratio of the impellor to the size of the mixing chamber shall be such as to ensure that optimum mixing of the contents occurs. The mixing intensity selected to achieve complete mixing of the lime with the thickened sludge supernatant and the digested sludge filtrate shall be such as to achieve a velocity gradient range of  $G=900$  to 1000 per second.

All parts below water level shall be manufactured from stainless steel.

The flash mixer shall be mounted on stainless steel supports which form part of this section of the Contract. Full details are to be supplied in the Tender.

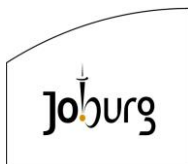
The mixer in the mixing box shall be mounted on stainless steel supports and the supports form part of this contract. Full details are to be supplied in the Tender.

##### b. Lime Reactor Mixers

Six vertical shaft platform mounted slow speed low shear radial flow mixers are required in the lime reaction tanks. The details of the reaction tanks are shown on drawing 10261-70-7001. The volume of each tank is 97 m<sup>3</sup> at a water depth of 2150 mm and the distance from the top of the platform to the top of the floor is 2800 mm. All parts below water level shall be manufactured from stainless steel.

Each mixer shall impart at least 30 W/m<sup>3</sup> into the lime reaction tank and shall have a minimum rated output of 4 kW.

Employer:		Contractor:	
Witness:		Witness:	



c. Rotary Vane Feeders

Two feeders shall each be capable of dosing hydrated lime at 475 kg/hr, with feed rate variation being achieved by means of a timer.

The timer shall be supplied and installed by the Contractor under this Contract. A manual adjustable override must be provided.

All bearings shall be external to the feeder housing, thereby having no contact with the lime and being readily accessible for maintenance. All bearings shall be of split type and shall be easily maintainable.

d. Dry Lime Screw Feeders

The screw feeder shall be installed at an angle of  $\pm 45^\circ$  to transport the dry lime to the top of the make-up tank. The start of the screw feeder shall be connected to the Rotary Vane Feeder with a closed pipe with an access inspection hatch. The top of the screw feeder shall be closed with multiple accessible cover plates.

e. Lime Make-up Tanks

Two mild steel Lime Make-up tanks of 5000 liters each shall be installed to replace the existing mixing bowls. The Make-up Tanks shall be equipped with a mechanical mixer, wash water supply pipe, lime inlet from screw feeder, access hatch, drainpipe, lime slurry outlet pipe, overflow pipe, cat ladder with lockable access gate and handrailing at roof. The wash water supply shall be done with a 50mm dia GMS pipe to each lime make-up tank operated with solenoid valves including bypass piping with manual valves shall be installed.

f. Lime Slurry Interconnecting Pipework

All delivery pipework shall be provided under this section of the Contract. The lime slurry delivery pipework shall be designed and installed to be self-cleaning and to prevent the deposition of lime solids at any point along the delivery pipeworks.

Tenderers must allow for  $\pm 10$  m of 150 mm nominal diameter SS304 delivery pipework from the lime make-up tanks to the dosing point, including all necessary

Employer:		Contractor:	
Witness:		Witness:	



fittings. Actuated valves shall be installed on the outlet from each tank with wash water connections operated by solenoid valves.

All fasteners, clips, bolts, etc must be of 304 L stainless steel.

g. Lime Clarifiers

The overflow from the WAS Thickeners flows to the Lime Reactor where it is mixed with the Lime Slurry to raise the pH and then it flows to the Lime Clarifier Division Box where it is split into the four Lime Clarifiers.

The Lime Clarifiers have a diameter of 25m and a side wall depth of 4m.

The bridges are half bridges with peripheral drives and a full floor sludge scraper.

h. Corrosion Protection

Corrosion protection must be carried out strictly in accordance with the requirements of the Particular Specification for Corrosion Protection: Volume GO2 to the following systems:

Motors, speed reducers, base plates etc: System D.1 (colours to conform with colour scheme selected by Engineer). If existing paint on these items are incompatible with vinyl paint, the Contractor shall provide suitable alternatives approved by the Engineer. Where exposed to splashing, etc. System B1 or B3

Exterior of lime make-up tank, etc: System B.4 (colours to conform with colour including support structure and scheme selected by Engineer)

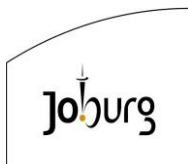
Equipment shall be painted a further final coat after installation of equipment. (Only systems D.1 and B4)

Measurement and Payment

The tenderer must allow in his rates for the following:

- Dismantling and removal of the existing lime mixing bowels, rotary vane feeders, valves, mixers, Silo load cells and Lime Clarifiers Mechanical Equipment (bridges, floor scraper, etc) to be taken to the tenderer's workshop for inspection
- Storing of mechanical equipment at tenderer's workshop

Employer:		Contractor:	
Witness:		Witness:	



- Transporting of mechanical equipment back to site for installation or client's storage
- Move of Lime Silo to new position including installation of load cells
- Installation and commissioning of refurbished equipment
- Design, Supply, Delivery to site of new mechanical equipment according to the specification
- Installation and Commissioning of new mechanical equipment according to the specification

#### **PSX1.8. MACERATOR PUMP STATION**

##### General

The Macerator Pump Station was constructed initially with Module 1 Head of Works when different type of Fine Screens was installed. All dirty water from all the bunded areas drains to this pump station, therefore this Pump station will in future only be used to return the drainage water back to the main channel upstream of the Fine Screens.

##### Reference Drawings

18056-73-03-115 Macerator Pump Station As-Built

18056-73-03-116 Macerator Pump Station Refurbishment

Reference must also be made to the drawing list in Volume 1 of the tender documents.

##### Particular Specifications

This specification shall be read in conjunction with the Particular Specification M18 Mechanical Centrifugal Pumps.

##### Particular Specification of Pumps

The existing pumps and pipework in the pump station must be replaced with new pumps and pipework. The pumps shall be installed with flooded suction as the

Employer:		Contractor:	
Witness:		Witness:	



suction will be from the adjacent sump with the delivery to the channel next to the pump station.

Each pump shall have a duty of 10 l/s at a total head of 4.4m and the two pumps shall be installed with its own suction pipe from the adjacent sump and shall operate as one duty and one standby.

A new submersible floor drainage pump with delivery pipe also to the channel to replace the existing pump. The pump shall have a duty of 3l/s at a total head of 5m.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of Pump Station
- Dismantling and removal of the existing pumps and pipe work inside the pump station to the client's storage area
- Design, Supply, Delivery to site of two new centrifugal pumps with stainless steel interconnecting pipe work and valves according to the specification
- Installation and Commissioning of two new centrifugal pumps with stainless steel interconnecting pipe work and valves according to the specification
- Design, Supply, Delivery to site of one submersible floor drainage pump with stainless steel interconnecting pipe work and valves according to the specification
- Installation and Commissioning of one submersible floor drainage pump with stainless steel interconnecting pipe work and valves according to the specification

#### **PSX1.9. PRIMARY SEDIMENTATION TANKS EQUIPMENT**

##### General

The mechanical equipment of all the five number Primary Sedimentation Tanks requires refurbishment or replacement.

##### Reference Drawings

18056-73-13-100 General Arrangement

Employer:		Contractor:	
Witness:		Witness:	



18056-73-13-101 Primary Sedimentation Tank 3D View -As Built

18056-73-13-102 Primary Sedimentation Tank Layout & Section - As Built

18056-73-13-103 Primary Sedimentation Tank Layout & Sections –  
Refurbishment

Reference must also be made to the drawing list in Volume 1 of the tender documents.

#### Particular Specifications

This specification shall be read in conjunction with the Particular Specification M03 - Mechanical Primary Sedimentation Tanks Equipment.

#### Particular Specification of Primary Sedimentation Tank Equipment

The screened and degritted Raw Sewage from Head of Works will flow to the Primary Sedimentation Division Box where it will be split between the five Primary Sedimentation Tanks.

The existing mechanical equipment of the Primary Sedimentation Tanks need to be refurbished or replaced.

The Mechanical Equipment for the Primary Sedimentation Tanks is to suit an internal tank diameter of 35m and a side wall depth of 3.5m as detail in the above referenced drawings.

The tanks have a half bridge (which only need to be refurbished) and a full floor sludge scraper.

PST's 1 to 4 are equipped with peripheral drives while PST 5 has a centre drive which must be changed to peripheral drive.

#### Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of the tanks
- Dismantling and removal of the Bridge, Scum and Sludge Scraper system to be taken to the tenderer's workshop for inspection and refurbishment
- Refurbishment of the bridge

Employer:		Contractor:	
Witness:		Witness:	



- Refurbishment of the scum discharge knife gate valves
- Storing of mechanical equipment at tenderer's workshop
- Transporting of mechanical equipment back to site for installation or client's storage
- Installation and commissioning of refurbished equipment
- Design, Supply, Delivery to site of new mechanical equipment according to the specification
- Installation and
- Commissioning of new mechanical equipment according to the specification

#### **PSX1.10. FERMENTER TANKS EQUIPMENT**

##### General

The mechanical equipment of both of the Fermenter Tanks requires refurbishment or replacement.

##### Reference Drawings

18056-73-14-100 General Arrangement

18056-73-14-101 Fermenter 3D View -As Built

18056-73-14-102 Fermenter Layout & Section - As Built

18056-73-14-103 Fermenter Layout & Sections – Refurbishment

Reference must also be made to the drawing list in Volume 1 of the tender documents.

##### Particular Specifications

This specification shall be read in conjunction with the Particular Specification M11 - Mechanical Fermentation Tanks Equipment.

Employer:		Contractor:	
Witness:		Witness:	



### Particular Specification of Fermenter Tank Equipment

The sludge that settled on the floor of the Primary Sedimentation Tanks is pumped to the division box of the Fermenters where it is divided to the two Fermenter Tanks.

The existing mechanical equipment of the Fermenter Tanks need to be refurbished or replaced.

The Mechanical Equipment for the Fermenter Tanks is to suit an internal tank diameter of 25m and a side wall depth of 4.0m as detail in the above referenced drawings.

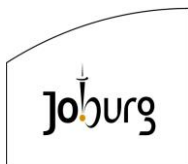
The tanks have a half bridge (which need to be refurbished or replaced) with peripheral drive but a full floor scraper.

### Measurement and Payment

The tenderer must allow in his rates for the following:

- Emptying of the tanks
- Dismantling and removal of the Bridge, Scum and Sludge Scraper system to be taken to the tenderer's workshop for inspection and refurbishment
- Refurbishment of the bridge
- Refurbishment of the scum discharge knife gate valves
- Storing of mechanical equipment at tenderer's workshop
- Transporting of mechanical equipment back to site for installation or client's storage
- Installation and commissioning of refurbished equipment
- Design, Supply, Delivery to site of new mechanical equipment according to the specification
- Installation and
- Commissioning of new mechanical equipment according to the specification

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX2 GENERAL MECHANICAL ENGINEERING

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Employer:		Contractor:	
Witness:		Witness:	



## **PSX2.1 SCOPE**

This specification sets out the general requirements applicable to mechanical installations and shall apply where it is relevant to the Contract unless it is superseded by the project specification.

## **PSX2.2 DESIGN SPECIFICATION**

### **PSX2.2.1 General**

This Specification lays down the performance, quality and overall system requirements of the Works. Deviation from the Specification will only be considered if the Employer's Agent considers such deviation an improvement.

### **PSX2.2.2 Safety**

Safety shall be an all important and overriding consideration and proper attention shall be paid to this aspect at the design stage. Equipment which is potentially dangerous shall be designed in accordance with a relevant South African or international Standard.

Hazards must be avoided or guarded. Nip points shall be guarded; sharp corners shall be rounded off; operating handles, supports and protrusions shall be kept clear of access ways.

Moving parts shall be properly guarded to the satisfaction of the Employer's Agent.

An emergency stop button shall be installed in a convenient position next to each machine. The installation shall be designed to provide immediate access without the danger of accidental operation. In addition, trip wires which will stop the driving motor when pulled shall be provided along the accessible side/s of moving conveyor belts, chains and the like irrespective of operating speed and irrespective of guards provided.

Where, in the opinion of the Employer's Agent, an installation is not safe, the Contractor shall remedy such defect at his own cost to the satisfaction of the Employer's Agent.

### **PSX2.2.3 Design Factors**

Employer:		Contractor:	
Witness:		Witness:	



A high quality standard is demanded and reliability, long life, trouble free operation, efficiency, ease of maintenance and operation, and neatness are essential.

All plant and equipment shall be of robust construction and the design shall, as applicable, be based on:

- the full range of duties which can be reasonably anticipated;
- the power and torque transmitted by the driver system under full load and stalled conditions;
- the maximum pressure or vacuum which can be produced by pumps, blowers and compressors under all conditions including blocked or closed inlet and outlet circuits;
- conservative service and safety factors based on approved standards or laid down in the printed specifications of reputable and approved manufacturers;
- a safety margin of at least 20% in addition to any service or safety factors which apply;
- twenty four hour per day operation;
- a minimum life of 100 000 hours before repair or major part replacement; and
- prevention of serious damage from normal operational problems such as blockages, blinding, jamming, seizure, malfunction and, as far as is practical, maloperation; if these occurrences cannot be avoided by good design.

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

#### **PSX2.2.4 Fail-Safe Operation and Protections**

Where damage can occur from normal operational or other foreseeable problems, plant, equipment and systems must be designed to be fail safe; i.e. must have built-in redundant elements, or be fail-to-safe; i.e. must return to a safe condition

Employer:		Contractor:	
Witness:		Witness:	



where no further damage can be done in the event of a failure, malfunction, maloperation, overload and, as far as practical, misuse. All reasonable and economically justifiable protections to prevent or limit damage to plant and equipment, particularly in high risk situations, must be incorporated. Protections shall:

- be directed at the source of the problem, limit forces to safe levels and act quickly enough to prevent;
- stop or prevent from starting all equipment at risk;
- activate an alarm with a labelled indicator on the control panel whenever a protection operates;
- not permit unauthorised tampering; and
- operate reliably after long inactive periods exposed to corrosive and dirty conditions.

#### **PSX2.2.5 Moving Parts**

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

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

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

On abrasive applications abrasion resistant materials and slow speed operation shall be utilised.

Susceptibility to fatigue failure shall be minimised by proper design and manufacturing procedures. In particular, changes in section shall be radiused and care must be taken to avoid the use of welded components in areas of fluctuating stress.

Employer:		Contractor:	
Witness:		Witness:	



The locking of nuts and pins in position shall be done to the approval of the Employer's Agent.

Wearing parts shall be designed for interchangeability and ease of removal and replacement.

#### **PSX2.2.6 Arrangement and Mounting**

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

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

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

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

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

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

#### **PSX2.2.7 Lifting Equipment**

All lifting equipment shall comply with the following requirements unless otherwise stated:

All aspects of lifting equipment, including design, fabrication and installation work shall be full in accordance with the relevant aspects of the Occupational Health and Safety Act and Regulations.

Lifting equipment shall be designed and constructed in accordance with a generally accepted technical standard.

The safe working load (SWL) shall be marked clearly on all items.

Employer:		Contractor:	
Witness:		Witness:	



The complete installation shall be inspected and shall be tested over its complete lifting range using a load which is at least 125 % of the safe working load.

High-tensile or alloy steel chains shall have a factor of safety of at least four.

Chains shall have a factor of safety of at least five.

Steel-wire ropes shall have a factor of safety of at least six.

Man made fibre ropes or woven webbing shall have a factor of safety of at least six.

Natural fibre ropes shall have a factor of safety of at least ten.

## **PSX2.3 MATERIALS OF CONSTRUCTION**

### **PSX2.3.1 Installation**

#### **PSX2.3.1.1 General**

The Works shall comply with the following:

When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

The requirements of Sub-clause "Arrangement and Mounting" must be noted.

The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.

The Contractor is not responsible for grouting puddle pipes which pass through liquid retaining walls or slabs but shall be responsible for all other grouting necessary for all plant and equipment.

The use of more than three shims in the alignment of equipment will not be permitted. Machined spacers shall be prepared where necessary. Shims and spacers shall be of a corrosion resistant material such as stainless steel.

Corrosion protection requirements shall be carefully attended to and the relevant paragraphs of Sub-clause "Paint Application" (see Clause "Corrosion Protection:

Employer:		Contractor:	
Witness:		Witness:	



Paint Coatings) must be noted. All mating faces must be coated before and sealed after assembly.

Fastener threads must be coated with a nickel-based, anti-seize compound before assembly.

Crevices which are formed between two surfaces shall be filled, prior to final fastening, with a suitable formable packing. This applies particularly to stainless steel.

#### PSX2.3.1.2 Alignment of Shafts

Shafts for drives, such as motors, with an output above 150 kW shall be aligned to the driven shaft as follows:

Final alignment shall be done after installation and before commissioning, shall be checked in the presence of the Employer's Agent and shall be to his approval. Alignment shall be sufficiently accurate to ensure that no initial pre-load is placed on the shaft coupling.

Each motor shall be aligned to its pump using laser aligning equipment.

The use of pourable epoxy resin chocks shall be acceptable. If pourable chocks are used, the baseplate feet do not have to be machined but each machine foot shall be provided with a screw for vertical alignment. The chock thickness shall not be less than 20 mm.

#### PSX2.3.1.3 Materials

Materials – generally

All materials used in the manufacture and construction of plant and equipment shall be new, unused and shall be the best of their respective kinds. The Contractor shall ensure that the materials are selected in accordance with the best engineering practice to suit the working conditions and the extremely corrosive environment.

Steel

All structural steel shall comply with the requirements of SANS 1431 grade 300W and shall be legibly marked with the maker's name or trade mark and identification marks.

Employer:		Contractor:	
Witness:		Witness:	



## Plastics

Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application. PVC is regarded as too brittle and shall not be used unless called for in this Specification or approved in writing by the Employer's Agent before supply.

### PSX2.3.1.4 Castings

Castings shall comply with the relevant South African or British Standard for the material used, including the following:

Grey Cast Iron Castings	-	SANS 1034	BS.1452
S.G. Iron Castings	-	SANS 936/7	BS.2789
Steel Castings (General Purpose)	-	SANS 1465	BS.3100
Aluminium Castings	-	SANS 989/992	BS.1490
Copper and Copper Alloy Castings	-	SANS 200	BS 1400

Particular attention shall be paid to cleanliness, soundness and neat fettling and dressing of castings. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity and sand and slag inclusions will not be tolerated. Areas under bolt heads, nuts and washers, shall be machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.

All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Employer's Agent and welding will not be permitted on cast iron castings.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out.

### PSX2.3.1.5 Fabrication of Carbon Steels

Employer:		Contractor:	
Witness:		Witness:	



## Standards

Steelwork shall be constructed, fabricated and erected in accordance with SANS 1200H where applicable.

## Finish

Weld spatter and other protrusions shall be removed. Sharp edges shall be rounded to a radius of at least 2 mm.

## Requirements for corrosion protection

In addition to finishing requirements, the requirements of corrosion protection application shall be taken into consideration. All surfaces must be accessible for surface preparation and coating. Inaccessible pockets, open hollow sections or the like shall not be permitted except where hot-dip galvanizing (without painting) is called for. Surfaces which cannot be properly prepared after fabrication must be abrasive blasted and coated with a two-pack epoxy pre-weld primer before fabrication.

## Inspections

The Contractor shall arrange for the Employer's Agent to inspect fabrications, including fabricated pipework, in the fabrication workshop and prior to corrosion protection.

### PSX2.3.1.6 Fabrication of Stainless Steels

The requirements regarding the fabrication of carbon steels apply to the fabrication of stainless steels as well. In addition, the following requirements apply to the fabrication of stainless steels.

Surfaces which become contaminated with steel or otherwise stained or otherwise marked so as to be of uneven colour, shall be cleaned by pickling or electro-cleaning rather than by grinding.

The Contractor shall arrange for the Employer's Agent to inspect fabrications, including fabricated pipework, in the fabrication workshop.

### PSX2.3.1.7 Welding

Employer:		Contractor:	
Witness:		Witness:	



## General Welding Requirements

Standards: Standards complying with good modern practice, and acceptable to the Employer's Agent, shall be adopted. These include the following:

- BS 5135 - Arc welding carbon and carbon manganese steelwork.
- BS 4677 - Arc welding austenitic stainless steel pipework.
- BS 2633 - Class 1 Arc welding of steel pipework.
- BS 2971 - Class II Arc welding of steel pipework.
- BS 806 - Design and construction of ferrous piping in connection with land boilers (used for arc welding specification of all pipe flanges).

Welders shall be experienced competent artisans approved in accordance with BS 4872.

Welding to be continuous: All welding shall be continuous on all sides of any joint unless otherwise approved in writing by the Employer's Agent. No crevices will be permitted and where stitch welding has been approved by the Employer's Agent, the crevices so left shall be sealed with an approved filling compound after priming but before further painting.

Weld appearance: Welding shall be free of blowholes and all welding flux shall be removed. All weld spatter and other sharp imperfections shall be removed prior to abrasive blasting. Prior to painting, weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground. Weld grinding must not be performed on 304L or 316L stainless steel, however, unless unavoidable.

Site welding: Site welding shall be kept to a minimum and shall only be undertaken with the approval of the Employer's Agent.

Type of stainless steel: Austenitic stainless steels to be welded shall be of the low carbon grade (i.e.: 304L, 316L, etc.).

Welding rods: The welding rods used shall be the most suitable for the metal and purpose. Type 309 stainless steel welding rods shall be used for welding 3CR12 unless otherwise approved in writing.

Welders: Only welders experienced with welding stainless materials shall be used.

Employer:		Contractor:	
Witness:		Witness:	



General: All possible steps shall be taken to ensure maximum corrosion resistance, strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall be passivated. Discolouration and steel contamination must be removed by pickling or electro-cleaning as approved by the Employer's Agent but should rather be avoided by taking the appropriate measures.

#### PSX2.3.1.8 Guards

Guards shall comply in all respects with the Occupational Health and Safety Regulations and the following points shall also be noted: -

Guards are required to cover all moving or revolving components of machinery. Guards which do not adequately cover moving protrusions such as keys, lock-nuts, lockwashers, setscrews, etc., or irregularities such as keyways, will under no circumstances be accepted.

Guards shall be neatly and rigidly constructed and fixed and shall not vibrate or cause noise during operation.

Where expanded metal or similar mesh is used, the mesh opening shall not permit a circular object 10 mm or larger to penetrate.

Mesh shall not be used for chain guards but on belt drives the side of the guard most conveniently sited for inspection shall be constructed of expanded metal or similar. Mesh should similarly be used in other situations where inspection or ventilation is required.

Guards shall completely enclose drives and shall entirely prevent a person from touching any moving protrusion.

Allowance must be made for adjustment on belt guards or where adjustment will be required.

It shall be possible to remove the guard easily for maintenance purposes.

Guards shall preferably be fabricated of 316 stainless steel (uncoated) but may also be hot-dip galvanized, zinc-sprayed or aluminium-sprayed carbon steel, coated to specification in all these cases. Fasteners shall be M10 or larger and shall be of 316 stainless steel.

Employer:		Contractor:	
Witness:		Witness:	



#### PSX2.3.1.9 Machine Vibration Levels

The mechanical vibration of machines measured at all important points such as bearings shall be lower than that specified as "good" for that class of machine in BS 7854 (ISO 10816).

#### PSX2.3.1.10 Noise Control

Noise levels

The noise level of the complete installation shall not exceed the following:

- a maximum noise level at the Site boundaries not exceeding an equivalent continuous sound level of 55 dB(A) when all equipment installed is being operated; and
- a maximum noise level at a distance of 1 m of each sound producing mechanical equipment of 80 dB(A).

Where the Contractor is unable to restrict the noise level of the machines to the maximum specified, by the appropriate selection of suitable equipment; e.g. by selecting slow speed or silent type machines, quiet type cooling fans, suitable silencers, etc. then an alternative solution, such as an acoustic hood or similar shall be offered.

#### PSX2.3.1.11 Bearings

Bearing systems shall be designed to provide safe shut down without damage under normal stoppages as well as electrical supply failure.

#### PSX2.3.1.12 Lubrication

Grease Lubrication

Grease lubrication is preferred and all greasing points must be easily accessible.

Equipment with multiple greasing points shall be provided with grease lines which are piped, separately, to a single easily accessible position.

In cases in which motorised lubrication is provided to more than one destination, a distributor shall be provided. The distributor shall be a positive displacement device which ensures equal, successive lubrication to all destinations.

Employer:		Contractor:	
Witness:		Witness:	



Pipework for grease distribution shall be of stainless steel or non-ferrous metal.

Oil lubrication

Oil level indicators shall be fitted for visual checking. Drain cocks, including 316 SS fittings where necessary to permit convenient draining, and plugged at the end, shall be provided for oil reservoirs exceeding 1,5 litre capacity. Drains shall be from the lowest point and syphon type drains are unacceptable.

Lubrication systems shall be designed to exclude dirt and moisture. Air vents on the oil reservoir shall contain an air filter.

#### **PSX2.4 MEASUREMENT AND PAYMENT**

The provision of all general mechanical design, construction and material requirements as specified within this standard specification shall be included for in the overall price of equipment offered.

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX3 OPERATION AND MAINTENANCE MANUALS

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Employer:		Contractor:	
Witness:		Witness:	



### **PSX3.1 SCOPE**

This specification covers the supply of Operation and Maintenance manuals as called for in the schedule of pricing. The specification sets out the general requirements applicable to the Operation and Maintenance manuals and shall apply where it is relevant to the Contract unless it is superseded by the project specification.

### **PSX3.2 GENERAL**

The Contractor must submit one full set of provisional Operation and Maintenance manuals to the Employer's Agent for checking and remarks, at least one month before any commissioning and testing exercises are undertaken. The manuals will be returned to the Contractor, who is to incorporate the changes and comments into the final manuals, before re-submittal.

Three sets of the final Operation and Maintenance manuals must be submitted to the Employer's Agent once the manuals have received final approval. The Employer's Agent will thereafter distribute these final manuals to Client accordingly.

### **PSX3.3 LAYOUT OF THE MANUALS**

#### **PSX3.3.1 Appearance**

The manuals are to be firmly bound in plastic covered files suitable for A4 sized paper, information leaflets, suppliers' information and manuals. The Operation and Maintenance manuals are to have the following information on their covers and spines:

- Operation and maintenance manual for the specific project;
- Contractor's name, address and contact details; and
- Date at which the plant was handed over to the client.

All relevant information that is not of A4 size or which is of A4 size and cannot be bound / filed into the manual is to be folded / filed into an A4 plastic sleeve which in turn is to be bound into the final manual.

Employer:		Contractor:	
Witness:		Witness:	



Drawings on large format paper are to be neatly folded and placed in plastic sleeves so as to be removed and replaced easily.

All sections of the Operation and Maintenance manuals are to be clearly labelled and neatly partitioned.

The Operation and Maintenance manuals are to be sorted in accordance to the way the plant has been segregated into various working areas and / or stations. Repeated equipment is to be referenced or cross-referenced to the appropriate section of the manual where the relevant information for the equipment is filed.

### PSX3.3.2 Contents

The following details / information shall be included in the manuals:

#### a) Maintenance Requirements

- A summary, in tabular form, is to be provided for the major and minor services of the equipment supplied. Time intervals are to be clearly indicated.
- A summary, in tabular form, is to be provided for the standard inspection and adjustment of equipment supplied. Time intervals are to be clearly indicated.

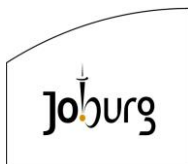
These summaries shall specify the recommended consumables and quantitative adjustments for the equipment including contact details of the relevant suppliers. Suppliers of spares if different are to be provided along with the original equipment manufacturers details. If specialized services or maintenance is to be carried out on the equipment, the contact details of these specialists are to be provided.

#### b) Technical

A detailed technical description / specifications shall be provided for all equipment supplied under. This shall as a minimum include:

- i. Tag number;
- ii. Details of the design of the equipment including working drawings and the description of the equipment;
- iii. Scope of operation including performance curves, where applicable;
- iv. Electrical requirements, where applicable;

Employer:		Contractor:	
Witness:		Witness:	



- v. Materials of construction including corrosion protection specification;
- vi. List of spares and where necessary additional tools.
- vii. Installation details; and
- viii. Condition monitoring specifications and requirements.

#### **PSX3.4 OPERATION AND MAINTENANCE**

The following procedures, operational philosophies and functions of the equipment shall be provided:

- For all equipment, the startup procedures shall be described including pre-start checks. This includes for equipment that automatically starts.
- Shut down procedures for all equipment is to be described.
- The operational time for each piece of equipment supplied shall be detailed.
- The maintenance schedule, regularity of maintenance along with the time intervals between maintenance periods shall be clearly stated.
- The checking of lubricant and coolant levels along with adjustment of machines shall be clearly described.
- Standard inspections, services and adjustments shall be described clearly along with time intervals of when these procedures are to occur.
- Major inspections, services and adjustments shall be described clearly along with time intervals of when these procedures are to occur.

#### **PSX3.5 MEASUREMENT AND PAYMENT**

All costs sustained from the compilation of the Operation and Maintenance manuals shall be deemed to be included in the schedule of pricing, where called for in the supply of these documents.

The tendered sum shall include for the supply of a complete set of Operation and Maintenance manuals per set of equipment supplied. Final payment for these manuals will only be transferred once the Employer's Agent has approved and received the final documents along with the relevant plant drawings.

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX4 MACHINE MOUNTINGS

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Employer:		Contractor:	
Witness:		Witness:	



#### **PSX4.1 SCOPE**

This specification covers the requirements for machine mountings which are to be included with all equipment offered and not as separate items.

#### **PSX4.2 DESIGN SPECIFICATIONS**

##### **PSX4.2.1 Common baseplates**

Both direct-coupled and belt-driven machines shall be mounted with their drivers on common cast iron or fabricated steel baseplates of rigid construction.

##### **PSX4.2.2 Corrosion protection**

Steel baseplates shall be hot-dip galvanized unless specified otherwise.

##### **PSX4.2.3 Machined mounting pads**

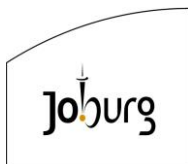
Baseplate shall incorporate machined mounting pads at the support and fixing positions of each item of plant and equipment to be mounted on the baseplate. On fabricated baseplates this machining shall be done after fabrication, stress relieving (if applicable) and hot-dip galvanizing are complete. The thickness of the solid pads shall be not less than 1,25 times the diameter of the holding down bolts. The pads shall not be provided with threaded holes for machine screws but shall be drilled for inserting through-bolts and adequate provision shall be made for reaching the nut with a suitable spanner. In the period between machining and installation of the equipment, the machined surface shall be protected against corrosion by a removable coating. After installation, a non-hardening compound, Tectyl or equivalent, shall be applied to exposed machined surfaces and to the crevice formed at the foot of the equipment.

The above design may be suitably modified if the Contractor uses a pourable resin based chocking system. Such chocks shall be at least 15 mm thick.

##### **PSX4.2.4 Fasteners**

Anchor fasteners shall be of grade 316 stainless steel with threads coated with a nickel-based, anti-seize compound before assembly.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSX4.2.5 Alignment**

Preliminary alignment shall be done at the factory to ensure that the baseplate has been correctly manufactured, but final alignment shall always be done on site after installation and grouting has been completed. Alignment shall be accurate and to the approval of the Employer's Agent and a final alignment check witnessed by the Employer's Agent must be carried out by the Contractor prior to start up.

#### **PSX4.2.6 Shimming**

Not more than three shims may be used at any point and these must be made of a corrosion resistant material.

#### **PSX4.2.7 Jacking screws**

At least two diagonally opposed jacking screws shall be provided for belt tensioning in the case of belt-driven units. Direct-coupled motors above 10 kW shall be provided with jacking screws for horizontal alignment and direct-coupled motors above 150 kW shall be provided with jacking screws for vertical alignment as well. Jacking screws shall be of grade 316 stainless steel.

#### **PSX4.2.8 Grouting**

Baseplates shall be designed and grouted as to eliminate collection points for water or dirt. Except where otherwise approved in writing by the Employer's Agent, all baseplates on concrete plinths shall be fully grouted in. Grouting holes must be provided on baseplates having a continuous top plate. Tapped holes and fixing setscrew protrusions shall be suitably protected.

The material used for grouting shall be a non-shrink, cementitious grout. The initial grouting shall be overseen by the supplier's technical representative.

#### **PSX4.2.9 Soleplates**

In applications where baseplates are not practical, machined soleplates, suitably fixed and grouted to the concrete plinths, shall be provided. No machine may be mounted directly onto a concrete base without the use of either a baseplate or soleplate.

Employer:		Contractor:	
Witness:		Witness:	



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### **PSX4.3 MEASUREMENT AND PAYMENT**

All mountings are to be included in the price for the item of equipment offered.  
Mountings are to be included as ancillary equipment where reference is made to  
“ancillary equipment”

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX5 GRID FLOORS, GUARD RAILS AND LADDERS

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Witness:		Witness:	



## **PSX5.1 SCOPE**

This specification covers the supply, delivery, offloading, transport, double handling (if required), storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period of all grid floors, guard rails and ladders.

## **PSX5.2 DESIGN SPECIFICATION**

### **PSX5.2.1 Grid flooring**

All grid flooring shall be Mentis type RS40 or equal approved with bearer bars across the shorter span. The depth of bearer bars shall not be less than 30 mm with a bearer bar pitch of not greater than 40 mm. Panels are to be set level and fixed down in angle frames so as to prevent rocking. All cut-outs in grid flooring for pipes, valve spindles and the like are to be banded and made before any corrosion protection is done. The edges of removable grid access covers must also be banded.

### **PSX5.2.2 Guard railing**

Guard railing shall be provided in accordance with legislated requirements and shall be provided generally in positions where the vertical change in level is 1 000 mm or greater.

Guard railing shall comply with SANS 0104.

All guard railing shall be of grade 316 stainless steel and shall comprise hand and knee rails not less than 32 mm diameter and stanchions spaced at not more than 1,8 m except where specifically directed otherwise in writing by the Employer's Agent.

On platforms, walkways, landings or around dangerous areas the vertical height, measured from the top of the hand rail to the floor or surface, shall be at least 1 000 mm.

On stairways and fixed ladders the rails shall be parallel to the stringers, and the vertical height, measured from the top of the hand rail to the nosing of the tread, shall be at least 900 mm.

Employer:		Contractor:	
Witness:		Witness:	



For applications covered by this Specification, the rails and stanchion shall withstand, without permanent deflection, a proof force of 890 N and 1780 N respectively, applied at any point and in any direction. Contractors shall provide proof that their guard railing has been tested and withstands these loads. The loads specified in SANS 10160 for guard railing and stanchions are to be adhered to.

Stanchions and rails shall be smoothly finished and free from sharp corners, edges and projections which may injure persons or damage clothing. Stanchion bases shall have the corners rounded or sheared off.

Railing, if tubular, shall be joined using the slip-jointing method with separate and neatly fitting tubular inserts fitted into the railing bore. If used, pins shall have their ends peened over and smoothed or, if taper pins are used, shall be filed off flush with the rail. The joint shall withstand the loads specified above when situated in any position including centrally between two stanchions. Joints shall preferably be located inside the stanchion balls. All joints shall be sealed.

Railings shall be ended off with positively fixed (pinned) closure bends. At corners, short radius bends with stanchions on both ends shall be employed or, alternatively, stanchions specifically designed for such a position shall be employed. No sharp endings will be permitted.

Stanchions shall generally be base-mounted to suit the arrangement requirements and shall be of solid or welded construction. Welding shall be compatible with the material, shall not impair the strength or corrosion resistance of the material, shall be continuous and shall be smoothly finished and then passivated.

Stanchions shall be self-draining to suit the mounting arrangement.

Holes for the rails to go through the stanchions shall have a diametral clearance not exceeding 1 mm but preferably 0,5 mm. On stairways with stanchions vertically mounted, the hole shall be angled to suit and shall accurately fit the angled rail with the abovementioned clearances. The crevices caused by rails passing through the stanchions shall be sealed.

Employer:		Contractor:	
Witness:		Witness:	



Stanchion feet which are attached to metallic surfaces shall have minimum dimensions of 150 mm X 60 mm. Two fasteners, of minimum size M16, shall be used to attach the foot. Foot material thickness shall be not less than 8 mm. Neatly fitting packing shall be fitted under stanchion feet to prevent the formation of crevices.

Stanchion feet which are attached to non-metallic surfaces shall have minimum dimensions of 150 mm X 150 mm. In instances where the horizontal surface to which the foot is to be fastened is less than 150 mm wide, the foot shall be designed to be seated on at least two surfaces. Four fasteners, of minimum size M16, shall be used to attach the foot to the concrete. Foot material thickness shall be not less than 10 mm. Non-shrink, cementitious grout shall be applied under the foot just prior to final tightening of nuts.

#### PSX5.2.2.1 Guard railing in public places

The requirements for guard railing at equipment installations shall also apply for guard railing for public places. The following specific requirements must also be complied with:

The structural design shall be done in accordance with the requirements of SANS 0104.

No opening in guard railing installed in public places shall allow the passage of a ball of 100 mm diameter.

### PSX5.2.3 Permanent ladders and stairs

#### PSX5.2.3.1 General

Permanent ladders shall comply, primarily, with the requirements of the OSH Act and, secondarily, with SANS 10400.

#### PSX5.2.3.2 Permanent ladders

Ladders shall comply with the following detail design aspects:

Access points to the head of ladders from platforms and walkways shall be protected by self-closing gates or by chains.

No part of the ladders shall project into the passageway.

Employer:		Contractor:	
Witness:		Witness:	



The clear width between stringers shall be between 450 mm and 550 mm.

A minimum clear space of 230 mm must be allowed behind the rungs.

The diameter of the rungs shall be between 20 mm and 50 mm.

Additional rungs shall be provided in the same horizontal plane as the top rung in order to close the gap between the platform and the ladder. Sufficient rungs shall be provided to ensure a maximum gap of 75 mm. These top rungs shall be at the same level as the floor or platform to which access is being provided.

Stringers shall be formed from flat bar. The vertical distance between the ladder support brackets shall not exceed 1 800 mm.

The stringers shall extend to 1 100 mm above the floor or platform and shall be matched with any guard rail protections at this level. Connections between hot-dip galvanized steel ladders and stainless steel guard railing shall be bolted. Unless laterally supported by the guard rails, these stringers shall be supported by vertical structural sections (not flat bar) whose footings shall comply with this Specification for guard rail stanchion feet.

All rises in a flight shall be uniform and the surface of the top rung shall be level with the top platform or landing. The height chosen for the rise shall be between 225 mm and 255 mm.

Except on chimneys, the height of a ladder should not exceed 6 000 mm. Greater heights shall be provided with intermediate landings between each 6 000 mm ladder section.

If the height between start and end levels is over 4 000 mm, the ladder shall be fitted with a safety cage. The safety cage shall extend at least 1 000 mm above the higher landing. The cage shall be no more than 700 mm away from the plane of the rungs. The cage shall comprise no fewer than seven vertical elements.

Anchor bolts shall be of grade 316 stainless steel and shall be no smaller than M16.

Stringers, rungs and anchor brackets shall be of solid structural sections (e.g. flat bar, round bar, square bar, angles, etc.) and no hollow sections will be accepted for any part of the ladder.

Employer:		Contractor:	
Witness:		Witness:	



#### PSX5.2.3.3 Stairs

Stairs shall comply with BS 5395

### PSX5.3 MATERIALS OF CONSTRUCTION

#### PSX5.3.1 Grid flooring

Grid flooring and frames shall be hot-dip galvanized after fabrication. Painting shall be done to suit the relevant safety codes.

Where grid flooring bears onto painted surfaces, strips of rubber insertion material shall be secured under the grid flooring to protect the paint.

The fixing clip set (saddle clamp and locking plate) shall be of hot-dip galvanised steel but all fasteners shall be of grade 316 stainless steel.

#### PSX5.3.2 Guard railing

All guard railing shall be of grade 316 stainless steel.

Stanchion feet shall be epoxy-coated.

A nickel-based, anti-seize compound shall be applied to all threads before fastening.

All components shall be supplied in the pickled and passivated condition which may also be polished. All surfaces must be uncontaminated and unmarked to ensure maximum corrosion resistance. A manufacturer's test certificate shall be provided for each batch of stainless steel giving the chemical analysis of the material.

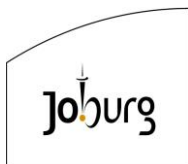
Inserts for internal slip joints may be of non-corrosive material using steel reinforcing provided the steel is completely enclosed.

Where kickplates are required by legislation, these shall extend to 150 mm above the walkway level.

#### PSX5.3.3 Permanent ladders and stairs

Unless other materials are specified, ladders and stairs shall be of carbon steel and hot-dip galvanized after all fabrication has been completed.

Employer:		Contractor:	
Witness:		Witness:	



## **PSX5.4 TESTING AND COMMISSIONING**

### **PSX5.4.1 Works testing**

Where applicable an inspection of the assembled units will be conducted at the manufacturer's premises to check material integrity, corrosion protection and fabrication soundness. Material certificates are to be issued to the Employer's Agent before deliver to site of the equipment.

### **PSX5.4.2 Tests on completion**

Performance testing will be carried out on the equipment after commissioning and adjustment. All tests are to be witnessed by the Employer's Agent, and Contractors must give the Employer's Agent 14 days notice prior to any test. The Contractor must cover the cost of any tests that need to be repeated as a result of the equipment not being able to meet the requirements outlined below.

The tests will be performed on the equipment over a single 8 hour shift. They shall consist of the following:

1. An inspection will be carried out to ascertain that the equipment has been installed correctly and with due diligence.
2. Any load testing required.

The equipment will be considered acceptable when:

1. Equipment has been correctly installed and satisfies the Employer's Agent.
2. The equipment passes any load tests called for.

During the Defects Liability Period

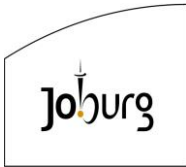
Checks on all equipment will be conducted for correct operation and functioning at 1 month, 6 months and 12 months after plant take-over.

## **PSX5.5 MEASUREMENT AND PAYMENT**

The unit of measurement shall be for the unit supplied including all ancillary equipment and accessories as specified.

The tendered rates shall include for full compensation for design, procurement, manufacture, factory testing, supply, delivery, off loading, storage, installation, commissioning and testing of all equipment, including holding down bolts and ancillary equipment.

Employer:		Contractor:	
Witness:		Witness:	



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INFRASTRUCTURE RENEWAL PLAN

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Part 3: Scope of Work



The tendered rates shall include for full compensation for the fixing of corrosion protection where needed and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX6 NUTS, BOLTS AND FASTENING SETS

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Employer:		Contractor:	
Witness:		Witness:	



## **PSX6.1 SCOPE**

This specification covers the requirements for fasteners and fastening sets which are to be included with all equipment offered and not as separate items.

## **PSX6.2 DESIGN SPECIFICATIONS**

### **PSX6.2.1 Fasteners general**

#### **PSX6.2.1.1 Standards**

Bolts and nuts shall be hexagon head type complying with SANS 1700 with threads of the coarse pitch series. Allen head screws of any type shall not be used without the Employer's Agent's written consent.

#### **PSX6.2.1.2 Fastener M12 and smaller**

All fasteners M12 and smaller shall be manufactured of grade 316 stainless steel.

#### **PSX6.2.1.3 Fasteners larger than M12 - in corrosive areas**

All fasteners in corrosive areas shall be manufactured of 316 SS. Corrosive areas shall be taken to include any moist or wet area such as in and above settling tanks, in or in the vicinity of open channels, where a continuous spray can be expected and all internal and external areas in the vicinity of the inlet works of a wastewater treatment works. All fasteners embedded in brick, concrete or soil shall also be of 316 SS.

#### **PSX6.2.1.4 Fasteners larger than M12 - Non corrosive areas**

Fasteners larger than M12 which are in non corrosive areas shall, except when specified otherwise, be hot dip galvanized.

#### **PSX6.2.1.5 High tensile bolts**

Where high tensile bolts are required by the design, they shall be hot dip galvanized and painted. The bolt holes and crevices shall be filled and sealed prior to painting.

Employer:		Contractor:	
Witness:		Witness:	



#### PSX6.2.1.6 Material compatibility

Fastener material shall always be of equal or better corrosion resistance than the items being fastened, e.g. 316 stainless steel bolts must be used to fasten together 316 stainless steel fabrications or flanges.

#### PSX6.2.1.7 Washers

Washers of similar material to the bolts shall be provided under each nut and setscrew head. Multiple washers or shims shall not be used. Spring washers or other approved locking arrangement shall be used on all fasteners subject to vibration.

#### PSX6.2.1.8 Anti seize compound

Before assembly, threads shall be treated with a nickel based, anti seize/corrosion protection compound; Chesterton 725: Nickel Anti Seize Compound, or equivalent. The thread shall be treated in the area under the final position of the nut. Compound on the exposed thread shall be cleaned off after installation. If it is found during inspection that compound has not been applied, the Contractor shall disassemble all fasteners and comply with this requirement.

#### PSX6.2.1.9 Thread projection

Bolt threads shall project between 1 and 6 mm from the head of the nuts when fixed. Longer projections will only be allowed if the Contractor can show that bolts of a more suitable length are not manufactured.

#### PSX6.2.1.10 Corrosion protection

After installation the exposed surfaces of bolts not made of 316 stainless steel shall be coated as for the items being fastened. If the use of Allen head or similar fasteners has been approved by the Employer's Agent, the recessed heads shall be filled with a suitable non hardening sealing compound.

### PSX6.2.2 **Anchor fasteners**

#### PSX6.2.2.1 Type and material

All anchor fasteners shall be of grade 316 stainless steel.

Employer:		Contractor:	
Witness:		Witness:	



Anchor fasteners for water retaining structures and for brickwork shall be of the chemical anchor fastening type. Anchor fasteners for other applications may be of the expanding type or chemical anchor type.

#### PSX6.2.2.2 Hook bolts

Grade 316 stainless steel hook bolts shall be supplied and grouted by the Contractor into pockets which will be provided in the concrete structure in accordance with the information to be supplied by the Contractor. The grouting products shall be used strictly in accordance with the manufacturer's instructions.

#### PSX6.2.2.3 Alternative anchor bolt

The use of 316 stainless steel "Hilti Kwik Bolt" stud bolts or similar may be used as an alternative where approved by the Employer's Agent. If steel reinforcing bars are encountered while the holes are being drilled, the Contractor shall knock a hole in the concrete around the steel and grout in a stainless steel hook bolt as described above.

#### PSX6.2.2.4 Through-bolt anchors

Where machinery is anchored by studs or bolts which extend through the supporting structure and is therefore fastened down with the use of nuts from both sides, these, together with associated washers and brackets, shall also be of grade 316 stainless steel.

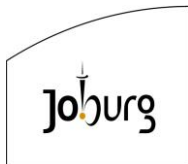
#### PSX6.2.2.5 Anti-seize compound

All threads shall be coated with an approved nickel based, anti seize/corrosion protection compound before assembly.

### **PSX6.3 MEASUREMENT AND PAYMENT**

All fasteners and fastening sets are to be included in the price for the item of equipment offered. The unit item offered will include the price of the fastener and fastening sets. Fasteners are to be included as ancillary equipment where reference is made to "ancillary equipment."

Employer:		Contractor:	
Witness:		Witness:	



## PARTICULAR MECHANICAL SPECIFICATIONS

### PSX7: STANDARD SPECIFICATION FOR FLUID CONTROL EQUIPMENT

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Employer:		Contractor:	
Witness:		Witness:	



## **PSX7: STANDARD SPECIFICATION FOR FLUID CONTROL EQUIPMENT**

### **PSX7.1 SCOPE**

The following specification covers the section of the contract for the design, supply, delivery, off loading, transport, double handling (if required), storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order for penstocks. The equipment is to be designed in accordance to DIN Spec 19704. Under full load, the yield strength and tensile strength of the materials must be within their limits.

### **PSX7.2 DESIGN SPECIFICATION**

#### **PSX7.2.1 General**

Equipment is to generally adhere to the below unless otherwise specified:

Equipment shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 304. Equipment is to be manufactured in stainless steel 316 in coastal areas or where the environment is highly corrosive. It is to be designed for minimum leakage and shall be provided with headstocks and rising spindles with wall mounted brackets. All equipment is to be hand wheel operated. Bevel gearboxes shall be provided. Gates shall move freely and smoothly in the frame and adjustment shall be provided using wedges manufactured from stainless steel or other approved non corrodible material. The wedges shall have a profile which will prevent seizure after long periods of immersion in a closed position. Frame sealing shall be arranged with the use of replaceable bulb section neoprene strips, and seals manufactured from a similar ultra violet resistance material shall be provided on the upstream face of all moving faces. The gate guides on channel penstocks shall extend upwards to fully accommodate the gate when fully opened.

Gate lifting spindles shall be of adequate diameter to open and close the gate against resistance without excessive deflection. The lifting nut shall be of bronze or gun metal with thread length equal to at least twice spindle diameter and cut with mating thread.

Employer:		Contractor:	
Witness:		Witness:	



Covers shall be provided for the spindles. The covers shall accommodate the full range of travel of the spindle and shall include external brass position indicators and be manufactured from robust polycarbonate material and provided with stainless steel 304 mounting flanges bonded to the covers.

#### **PSX7.2.2 Wall mounted sluice gates**

Wall mounted sluice gates shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 304. Wall mounted gates are to be manufactured in stainless steel 316 in coastal areas or where the environment is highly corrosive. Wall mounted sluice gates are to be designed for minimum leakage and shall be provided with headstocks and rising spindles with wall mounted brackets. The wall mounted gates are to be hand wheel operated. Bevel gearboxes shall be provided. The gate shall move freely and smoothly in the frame. The frame sealing for all sides of the wall mounted sluice gates shall be arranged with the use of replaceable bulb section neoprene seals of the “music note” or “J” types. The tenderer is to state if the sealing is “on” or “off” seating on the technical data sheets.

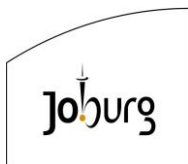
#### **PSX7.2.3 Twistlock gates**

Twist lock gates are similar to wall mounted sluice gates but are of a smaller size and where they are to be hand mounted. It will be able to be locked in any partially opened position by a cam mechanism forcing the gate against the frame. The same action is to be used for closing the gate. A head of 3 m for seating and a head of 2 m for unseating may be used. They may be fabricated from cast iron, cast stainless steel or mild steel with corrosion protection. Bronze seating faces are to be used.

#### **PSX7.2.4 Channel gates**

Channel Gates shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 304. Channel gates are to be manufactured in stainless steel 316 in coastal areas or where the environment is highly corrosive. Channel gates are to be designed for minimum leakage and shall be provided with head frame and rising spindles. The channel gates are to be hand wheel operated or otherwise stated. Bevel gearboxes shall be provided. The gate shall move

Employer:		Contractor:	
Witness:		Witness:	



freely and smoothly in the frame. Channel gate seals are to be manufactured from Neoprene. Angle type neoprene is to be used for the vertical members while compression type is to be used in the invert.

Channel gate lifting spindles shall be of adequate diameter to open and close the gate against resistance without excessive deflection. The lifting nut shall be of bronze or gun metal with thread length equal to at least twice spindle diameter and cut with mating thread. In cases where the spindle is excessively long due to a deep channel or higher than usual head frame, the spindle is to be supported by guides to prevent buckling. Twin lifting spindles with interconnected gearboxes are to be used for very wide gates.

Covers shall be provided for the spindles on all channel gates. The covers shall accommodate the full range of travel of the spindle and shall include external brass position indicators and be manufactured from robust polycarbonate material and provided with stainless steel 304 mounting flanges bonded to the covers.

The frame of the channel gate is to be embedded into the channel. Provisions for block outs in the channel are to be made by the civil contractor. Once the channel gate has been installed the civil contractor is to complete the necessary grouting in.

#### **PSX7.2.5 Weir gates (Downward Opening Weir Gates and Tilting Weirs)**

Downward opening weir gates shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 304. Downward opening weir gates are to be manufactured in stainless steel 316 in coastal areas or where the environment is highly corrosive. Downward opening weir gates are to be designed for minimum leakage and shall be provided with head stock, rising spindles and wall mounts. The weir gates are to be hand wheel operated. Bevel gearboxes shall be provided. Sealing will be achieved through ultra violet resistant neoprene seals of the “tri angular” or “J” types between sections and the installed arrangement shall provide an effective seal under all depths of immersion.

If the head is greater than the height of the opening, four sided seals are to be used if the flow is to be completely shut off. Otherwise three sided sealing is to be used.

Employer:		Contractor:	
Witness:		Witness:	



If the width of the gate is to be significantly greater than height of the gate, side extensions may be added to increase the effective height of the gate. In the case of not being able to add extensions to the gate, double lifting spindles with synchronized gearboxes are to be used.

Tilting weir gates shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 304. Tilting weir gates are to be manufactured in stainless steel 316 in coastal areas or where the environment is highly corrosive. Tilting weir gates are to be designed for minimum leakage and shall be provided with head stock, rising spindles and wall mounts. The weir gates are to be hand-wheel operated. Bevel gearboxes shall be provided. Along the hinged section, flat neoprene seals are to be fitted the installed arrangement shall provide an effective seal under all depths of immersion. Vertical travel shall not be more than 500 mm. A centrally mounted spindle is to raise and lower the tilting weir gate and it is to be hinged at the bottom.

Downward opening and tilting weir gates lifting spindles shall be of adequate diameter to open and close the gate against resistance without excessive deflection. The lifting nut shall be of bronze or gun metal with thread length equal to at least twice spindle diameter and cut with mating thread.

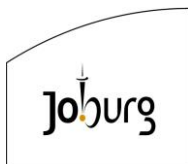
Covers shall be provided for the spindles on all downward opening and tilting weir gates. The covers shall accommodate the full range of travel of the spindle and shall include external brass position indicators and be manufactured from robust polycarbonate material and provided with stainless steel 304 mounting flanges bonded to the covers.

#### **PSX7.2.6 Hand stops and stop logs**

They are to be for manual installation and removal by two operators and the mass of each section shall not exceed 25 kg. The maximum width is to be no more than 1000 mm.

Provision shall be made for the easy attachment of lifting hooks to the hand stop/stop log eyes under submerged conditions and two sets of lifting hooks shall be supplied under this contract.

Employer:		Contractor:	
Witness:		Witness:	



Sealing will be achieved through ultra violet resistant neoprene seals between sections and the installed arrangement shall provide an effective seal under all depths of immersion.

The contractor shall design and supply a permanent frame manufactured from Aluminium sections to enable the storage and locking of hand stops.

The frame of the hand stop is to be embedded into the channel. Provisions for block-outs in the channel are to be made by the civil contractor. Once the hand stop has been installed the civil contractor is to complete the necessary grouting in.

#### **PSX7.2.7 Flap gates**

Flap gates are used to prevent reversal of flow at the end of pipes or walls. Gates are to be double hung by stainless steel pins in bronze bushes.

Smaller sized flap gates are to be fabricated in cast iron or cast stainless steel and to have bronze or stainless steel sealing faces. Larger sized flap gates are to be fabricated from stainless steel, or adequately corrosion protected mild steel. Neoprene seals are to be used.

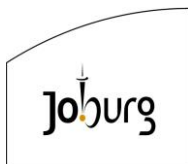
#### **PSX7.2.8 Sluice valves**

Sluice valves are cast into the floor of reservoirs and tanks for draining them. They may be supplied in cast iron, cast steel, stainless steel, corrosion resistant steel or mild steel. Bronze, neoprene or stainless steel may be used for the seats. The operation is to be by means of a hand wheel.

#### **PSX7.2.9 Hand flushing valves**

For draining fluid from tanks, hand flushing valves are appropriate for up to 3m of head and are to be of the quick opening lever operated type. They may be fabricated from either cast iron or cast iron stainless steel and be supplied with bronze seats.

Employer:		Contractor:	
Witness:		Witness:	



#### **PSX7.2.10 Ground water relief valves**

Ground water relief valves, where necessary, are cast into the floor of reservoirs, tanks, canals, etc. to relieve pressure caused by ground water. The maximum pressure head of 4 m is the recommendable allowable pressure. The body is to be fabricated from cast iron or cast stainless steel. The flexible disc and sealing disc are to be neoprene.

#### **PSX7.2.11 Fasteners**

All fasteners are to be manufactured from stainless steel 304.

#### **PSX7.2.12 Electric actuators**

Where electric actuators are to be used, they are to conform to the below details and to the relevant specification for actuators.

Electric actuators shall be adequately sized to accommodate the seating and unseating requirements. Travel duration from open to close or close to open position shall not be greater than 60 seconds for electric actuators.

The differential between supply and feedback signal on electric actuators shall not exceed 0,05 mA.

Status feed back contacts are to be provided for remote indication of:

- Open/closed position
- Torque trip at intermediate position
- Actuator fault
- Hand operation

#### **PSX7.2.13 Name plates**

A name plate, placed in a viewable position, is to be provided with the following information:

- Manufacturer's name
- Supplier's name
- Serial number

Employer:		Contractor:	
Witness:		Witness:	



- Size and type

### **PSX7.3 MATERIALS OF CONSTRUCTION**

#### **PSX7.3.1 Corrosion protection**

Corrosion protection shall be carried out in accordance with the requirements of the General Specifications for General corrosion Protection and to the following systems:

Stainless steels and 3CR12	:	Pickled and passivated
Mild steel	:	System - Fusion bonded epoxy coated
Aluminium	:	Anodised

### **PSX7.4 TESTING AND COMMISSIONING**

All channel gates, penstocks weir gates, tilting weirs and hand stops shall be checked for good installation and easy and correct functioning. All tests are to be witnessed by the Employer's Agent, and contractors must give the Employer's Agent 14 days notice prior to any test. The contractor must cover the cost of any tests that need to be repeated as a result of the equipment not being able to meet the requirements outlined below.

Performance testing will be carried out on the equipment after commissioning, adjustment and training of the Council's employees.

The tests will be performed on the equipment over a single 8 hour shift.

The tests shall consist of the following:

Correct operation.

Full opening and closing of the gate. Manual operation of a gate is to be achieved by one person at all times. Where there is actuation, the actuator is to achieve full opening and closing of the gate.

Visual inspection of gate sealing at their closed positions with liquid at the maximum level.

Electrical power use with a calibrated kWh meter (if equipment is actuated).

Employer:		Contractor:	
Witness:		Witness:	



Installation and removal of hand stops under dry and maximum flow conditions.

The equipment will be considered acceptable when:

1. The equipment meets the duty requirements as defined in this section of the Specification.
2. The tests defined above prove the acceptable operation of the equipment.

#### During the Defects Liability Period

Checks on all equipment will be conducted for correct operation and functioning at 1 month, 6 months and 12 months after plant take-over.

### **PSX7.5 SPARES**

A list of the recommended spares and consumables for a maintenance period of three years is to be provided in the technical data sheet. The list of spares is to be according to the equipment supplier's recommendations. Maintenance intervals of major and minor services are to be included.

### **PSX7.6 MEASUREMENT AND PAYMENT**

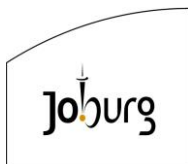
#### **PSX7.6.1 General**

Measurement and payment will distinguish between supply/delivery and installation/commission for each item of equipment as listed and priced only in the Schedule of Quantities. Payment will not be made for part supply of any listed item.

The respective tender item rates shall be deemed to cover all costs of equipment required within the scope of this Contract.

The tendered rates or sums shall cover the cost of design, drawings, manufacture, supply, testing at the manufacturers works, delivery to site, off loading, installation, site testing, setting into operation, the supply of O & M manuals, commissioning and maintenance during the warranty period of all equipment specified and also for anything not specifically mentioned but obviously required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material required for the proper installation of such equipment) to enable the equipment to

Employer:		Contractor:	
Witness:		Witness:	



be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned.

#### **PSX7.6.2 Testing**

The tendered sum shall cover the cost of all plant and personnel for conducting the testing, and in the case of the workshop and preliminary testing shall include the cost of any consumables.

For the acceptance testing, the consumables will be provided for the initial test only, by the Employer.

Employer:		Contractor:	
Witness:		Witness:	



## PORTION 4: PARTICULARS OF REQUIRED ELECTRICAL WORK

### PSY1 BACKGROUND INFORMATION

This section specifies the requirements for the manufacture, supply, delivery, installation and commissioning of the Electrical Work at Bushkoppie Wastewater Treatment Works IRP.

### PSY2 SCOPE OF WORK

The Electrical Work for the IRP consists of work at 6 x MV Substations & 1 x mini-substation replacement, Trash Screen at the main inlet channel, HoW Module 1 & HoW Generator, HoW Module 1 Coarse Screens, HoW Module 1 Grit Handling including blowers & compressors, HoW Module 1 Fine Screens, HoW Module 2 new skips / bins, HoW Module 2 Coarse Screens, Existing Wash Water Pump Station, Mixers at the Bio-Reactors, Secondary Clarifiers, Lime Plant, new HoW Module 2 Blower Building, new Wash Water Filter Station, PST's and Fermenters.

The Contractor shall provide all labour, supervision, installed and consumable materials, equipment, tools, services and every permanent or temporary item necessary for the manufacture, supply, delivery, unloading, installation, commissioning and putting into service of the specified deliverables.

Tenderers must note that a South African agent must be nominated for all major imported equipment. This agent must avail himself during the course of the project and must be present at all technical meetings.

The work comprises of the following:

The scope of work includes the following main items. The list does not include all that is required to provide a complete installation. The tenderer shall allow for all items of equipment required to provide a complete installation.

### SUPPLY INSTALLATION AND COMMISSIONING

- 11kV 630A RMU's
- 11kV 800A metal clad vacuum circuit breakers.
- Programming of incomer / feeder & motor protection relays.

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN



Volume 2A  
Part 3: Scope of Work

- 11kV / 110V 200VA VT panel.
- Battery Tripping Unit (BTU)
- 315kVA, 11kV / 400V mini substation
- MV cabling and termination.
- MV cable jointing.
- Cable route markers.
- Excavation & backfilling of cable trenches.
- LV cable and termination.
- Motor stop start stations including pedestals.
- LV control panels.
- MCC panels.
- LV overhead busbars.
- Re-equipping of motor starter drive cubicles.
- Junction boxes.
- Limit switches.
- Proximity switches.
- Earth conductors.
- Cable ladders.
- Indoor emergency standby generator including sound attenuated louvers.
- Outdoor emergency standby generators.
- As-Built drawings & cable schedules.
- FAT of all equipment and the issuing of relevant test certificates as per specification.
- O & M manuals
- Pressure tests of all cables after installation

Equipment and work shall comply fully with all the requirements given in the applicable JW Particular specifications, Project specification and drawings.

**Tenderers must note that the Wastewater Treatment Works is operational and no disruption of the Plant will be allowed during the project. Allowances must be made when the new MV switchgear is installed in the six substations.**

Employer:		Contractor:	
Witness:		Witness:	



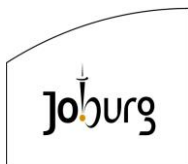
Equipment shall be of the highest quality and shall be suitable for continuous operation over long periods of time. Minimum maintenance and high, sustained efficiency is essential.

The contract also provides for the servicing and maintenance, by the Contractor, of the installed equipment, from the time that it is put into service, until the final Certificate has been issued.

### PSY3 APPLICABLE AND STANDARDIZED SPECIFICATIONS

NO	DESCRIPTION	DETAILS
1	Hot-dip (galvanised) zinc coatings heavy duty	SABS 763 – 1988
2	Quality systems	SABS ISO 9001, Parts I, II and III
3	National colour standards for paint	SABS 1091
4	Rotating electrical machines (Parts 1 to 18) (Applicable to low voltage motors)	SABS IEC 60034
5	Electric welded low Carbon steel pipes for aqueous fluids (ordinary duties)	SABS 719
6	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)	SABS 1507 : 1990
7	The selection, handling and installation of electric power cables of rating not exceeding 33 kV	SABS 0198 Parts 1-12
8	Induction motors Part 2: Low-voltage three-phase standards motors	SABS 1804-2 :2001
9	Induction motors Part 1: IEC requirements	SABS 1804-1 :2001
10	Code of Practice for the wiring of premises	SABS 0142-1 :2006 (SANS 10142-1: 2020)
11	Medium voltage installations above 1kV AC not exceeding 22kV AC and up to and including 3MVA installed capacity.	SANS 10142 – 2: 2018

Employer:		Contractor:	
Witness:		Witness:	



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11	Low voltage switchgear and control gear assemblies Part 1 : Requirements for type-tested and partially type-tested assemblies	SABS 1473-1  (SANS 60439 – 1 : 2004)
12	Safety of distribution boards	SABS 1765
13	Earthing of low-voltage (LV) distribution systems	SABS 0292 :2001
14	Uninterruptible Power Systems	SABS 1474 :1988
15	Parts I, II and III: Quality systems	SABS ISO 9001
16	Cable standard	SANS 1507 (Part 1-3) Electric cables with extruded solid dielectric insulation
17	National colour standards for paint	SABS 1091
18	Low voltage switchgear and control gear assemblies Part 1 : Type-tested and partially type-tested assemblies	SABS IEC 60439-1 :
19	The design and installation of an earth electrode	SABS 0199 :1985
20	Earth rods and couplers	SABS 1063 :1998
21	Specification for ISO metric black hexagon bolts, screws and nuts	BS 4190
22	Low voltage switchgear and control gear assemblies Part 2 : Particular requirements for busbar trunking systems (busways)	SABS IEC 60439-2:
23	Low Voltage Switchgear and Control Gear Part 1: General Rules	SABS IEC 60947-1
24	Low Voltage Switchgear and Control Gear Part 2: Circuit Breakers	SABS IEC 60947-2
25	Low Voltage Switchgear and Control Gear Part 3: Switches, disconnectors switch-disconnectors and fuse-combination units	SABS IEC 60947-3

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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26	Low Voltage Switchgear and Control Gear Part 4 : Contactors and motor-starters Section 1 : Electromechanical contactors and motor-starters	SABS IEC 60947-4-1
27	Specification General requirements for rotating electrical machines. Part 133	BS 4999
28	Classification of insulating materials	IEC 60085
29	Miniature Substations	NRS 004
30	Transformers	SABS 780
31	Miniature Substations	NRS 004
32	Occupational Health & Safety Act (Act 85 of 1993)	OHS Act

**PSY4      APPLICABLE JOHANNESBURG WATER SPECIFICATIONS**

NO	DESCRIPTION	DETAILS
1	Electrical Motors	E01 Rev 4
2	Electrical Cable Racks	E02 Rev 5
3	Electrical Isolator Pushbutton Station (Local start / stop Equipment	E03 Rev 5
4	Electrical Low Voltage Distribution Boards and Motor Control Centres	E04 Rev 6
5	Electrical Low Voltage Power and Control Cables	E05 Rev 5
6	Electrical Medium and Low Voltage Cable Installation	E06 Rev 5
7	Electrical Industrial Welding Plugs, Couplers & Socket Outlets	E07 Rev 4
8	Electrical Wiring	E08 Rev 4

Employer:		Contractor:	
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NO	DESCRIPTION	DETAILS
9	Electrical Building Installation	E09 Rev 4
10	Electrical Busbar Trunking	E10 Rev 4
11	Electrical Earthing & Lightning Protection	E11 Rev 5
12	Electrical Medium Voltage Cables	E12 Rev 4
13	Electrical Medium Voltage Switchgear	E13 Rev 4
14	Electrical Supply and Installation of a Standby Generator	E14 Rev 4
15	Electrical Transformer	E15 Rev 4
16	Electrical Uninterruptable Power Supply Units	E16 Rev 4
17	Electrical Variable Speed Drive (VSD) Units	E17 Rev 5
18	Electrical Mini Substations	E18 Rev 4
19	Electrical 11kV Ring Main Unit	E19 Rev 2
20	Electrical Overhead Lines up to 22kV	E20 Rev 1
21	Electrical Lighting and Illumination	E21 Rev 1
23	Electrical Power Factor Correction	E23 Rev 1
24	Electrical Battery Tripping Unit	E24 Rev 1
26	Electrical Colour Coding of Equipment	E26 Rev 1

## PSY5 LIST OF DRAWINGS

The following drawings form part of the Tender Document.

These drawings are for tender purposes only, and a set of construction drawings will be issued to the successful Tender at the commencement of the project. Reference must be made to the List of drawings in the Returnable documents.

Employer:		Contractor:	
Witness:		Witness:	



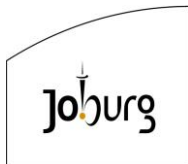
**Contract: JW 14425  
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<b>DRAWING NUMBER</b>	<b>DRAWING TITLE</b>
18056-73-12-100	Existing MV reticulation single line diagram
18056-73-12-101	Proposed MV reticulation single line diagram
18056-73-12-102	Substation No 1 layout
18056-73-12-103	Substation No 2 layout
18056-73-12-104	Substation No 0 layout
18056-73-12-105	Substation No 3 layout
18056-73-12-106	HoW Substation layout
18056-73-12-107	Blowers Substation layout
18056-73-12-108	HoW Typical 2.2kW Screenings Washer DOL starter drive schematic
18056-73-12-109	HoW Typical 2.2kW Screenings Compactor Forward / Reverse starter drive schematic
18056-73-12-110	HoW Typical 22kW Wash Water Booster Pump DOL starter drive schematic
18056-73-12-111	HoW Typical 15kW Air Blower DOL starter drive schematic
18056-73-12-112	HoW 2.2 kW Drainage Return Pump starter drive schematic
18056-73-12-113	HoW Module 1 Typical 2.2kW Grit Classifier Washer Stirrer DOL Schematic
18056-73-12-114	HoW Module 1 Typical 2.2kW Grit Classifier Washer Screw DOL Schematic
18056-73-12-115	HoW Module 1 Typical 2.2kW Degritters Static Screw Conveyor DOL Schematic
18056-73-12-116	HoW Module 1 Typical 3kW Macerator DOL Schematic
18056-73-12-117	HoW Compressor MCC Single Line Diagram
18056-73-12-118	HoW Typical 15kW Compressor DOL starter drive schematic
18056-73-12-119	HoW Compressor Pressure Switch schematic
18056-73-12-120	HoW skip winch & traversing conveyor position DOL starter drives schematic
18056-73-12-121	HoW Module Two 2.2kW Traversing Conveyor DOL schematic
18056-73-12-122	HoW Module 2 Typical 2.2kW Degritters Static Screw Conveyor DOL Schematic

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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DRAWING NUMBER	DRAWING TITLE
18056-73-12-123	HoW Module 2 Typical 2.2kW Grit Classifier Washer Stirrer DOL Schematic
18056-73-12-124	HoW Module 2 Typical 2.2kW Grit Classifier Washer Screw DOL Schematic
18056-73-12-125	HoW Module Two 2.2kW Degritters Drainage Return Pump DOL Schematic
18056-73-12-126	HoW Module 2 Typical 22kW Wash Water Booster Pump DOL starter drive schematic
18056-73-12-127	HoW Module 2 New Blower Room MCC Single Line Diagram
18056-73-12-128	Typical 15kW Air Blower DOL starter drive schematic
18056-73-12-129	Typical 15kW Air Compressor DOL starter drive schematic
18056-73-12-130	Compressor Pressure Switch schematic
18056-73-12-131	2.2kW Trash Screen VSD starter drive schematic
18056-73-12-132	1.1kW MCC Room fan DOL starter drive schematic
18056-73-12-133	Existing Wash Water Pump Station MCC Single Line Diagram
18056-73-12-134	Typical 30kW Wash Water Transfer Pump DOL starter drive schematic
18056-73-12-135	Typical 15kW Filter Feed Pump DOL starter drive schematic
18056-73-12-136	Typical 11kW Blower DOL starter drive schematic
18056-73-12-137	1.1kW MCC Room fan DOL starter drive schematic
18056-73-12-138	1.5kW extraction fan DOL starter drive schematic
18056-73-12-139	1.1kW Sump Pump DOL starter drive schematic
18056-73-12-140	New Wash Water Filter Station MCC Single Line Diagram
18056-73-12-141	Typical 15kW Filter Feed Pump DOL starter drive schematic
18056-73-12-142	Typical 11kW Air Blower DOL starter drive schematic
18056-73-12-143	1.1 kW MCC Room fan DOL starter drive schematic
18056-73-12-144	1.1 kW Sump Pump DOL starter drive schematic
18056-73-12-145	Typical 15kW Mixer DOL starter drive schematic

Employer:		Contractor:	
Witness:		Witness:	



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DRAWING NUMBER	DRAWING TITLE
18056-73-12-146	Typical 0.55kW Clarifier DOL starter drive schematic
18056-73-12-147	Typical 1.1kW Screw Conveyor DOL starter drive schematic
18056-73-12-148	Typical 2.2kW Lime Mixer DOL starter drive schematic
18056-73-12-149	Module 2 New Blower Building Lighting & Small Power Layout
18056-73-12-150	Wash Water Filter Station Lighting & Small Power Layout
18056-73-12-151	Existing Wash Water Pump Station Lighting & Small Power Layout
18056-73-12-152	HoW LV Reticulation.
18056-73-12-153	HoW Module 1 MCC Single Line Diagram.
18056-73-12-154	HoW Typical 1.5kW Screen Forward Reverse.
18056-73-12-155	LV Cable Schedules.

<b>As Built Drawings</b>
The Contractor shall be required to markup cable schedules and drawings with the “as built” information and return one print to the Engineer with all “as built” information entered thereon.
<b>Information to be submitted by the successful tenderer in respect of electrical equipment.</b>
<p>The successful Tenderer shall submit three paper prints of each of the following drawings, in respect of the MV Panels, BTU's, Mini Substation, concrete plinths for the mini substation and outdoor generators, indoor generator including louvers, outdoor generators, motor control centres, overhead busbars, local control panels, emergency stop stations, local motor isolators – stop / start stations, pedestals and concrete cable markers for approval prior to manufacture. The format of the schematic line diagrams shall be similar to the format indicated in the tender diagrams.</p> <p>a. Outline and general arrangement drawings, showing main overall dimensions and construction details.</p> <p>b. Wiring diagrams.</p> <p>c. Schematic line diagrams.</p>

Employer:		Contractor:	
Witness:		Witness:	



Prints of the following shall be supplied by the successful Tenderer in respect of each of the final As Built drawings.

- a. Outline and general arrangement drawings of the MV Panels, BTU's, Mini Substation, concrete plinths for the mini substation and outdoor generators, indoor generators including louvers, outdoor generators, motor control centres, overhead busbars, local control panels, emergency stop stations, local motor isolators – stop / start stations and pedestals for approval prior to manufacture
- b. Wiring diagrams
- c. Schematic line diagrams.

**In general, before commencement of manufacture, electrical / layout drawings must be submitted to the Engineer for approval / comment on all electrical equipment.**

#### **PSY6 11KV RMU'S & 11KV METAL CLAD CIRCUIT BREAKERS**

##### Blower House Substation - Metal Clad Switchgear

The MV incomer & feeder circuit breakers shall be spring actuated vacuum circuit breakers fitted with a feeder protection relay.

The MV motor circuit breakers shall be magnetic actuated vacuum circuit breakers fitted with a motor protection relay.

The spring and magnetic actuated breakers shall include a SCAME socket for remote operation via a 10 metre umbilical cord.

Before manufacture commences, detailed schematic diagrams of the switchgear shall be submitted to the Engineer for approval / comments.

Circuit breakers and panels to be tested to IEC 62271-100/200 and must have an IAC of 25kA for 1 second, AFLR.

Circuit breakers and panels to fully comply with IEC 62271-100/200, current and voltage ratings of cubicle designs must be tested, including bus section, bus riser, metering.

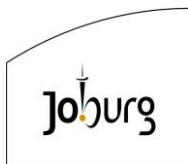
The circuit breakers must be type tested.

The cable live indicator must be of the VDS type and tested in accordance with IEC61243-5.

The preferred 11kV 800A incomer / feeder circuit breaker is the ACTOM SBV4E vacuum spring actuated circuit breaker or similar approved.

The preferred incomer / feeder protection relay is the ACTOM P122 feeder protection relay or similar approved.

Employer:		Contractor:	
Witness:		Witness:	



The preferred 11kV 800A motor circuit breaker is the ACTOM SBV5E vacuum magnetic actuated circuit breaker or similar approved.

The preferred motor protection relay is the ACTOM P225 motor protection relay or similar approved.

#### Substations 0, 1, 2, 3 & HoW - Ring Main Units

The preferred 11kV 630A motorised switch disconnecter is the ACTOM type RMV - "L" or similar approved.

The preferred 11kV 630A motorised vacuum circuit breaker is the ACTOM type RMV - "C" or similar approved.

The preferred circuit breaker protection relay is the ACTOM type "OCR" Self-Powered type or similar approved.

All units must be supplied with a pedestal and arc duct, and have an IAC of AFLR, 20kA for 0.5 seconds. Downward venting is not acceptable.

#### Emergency Dam Mini Substation.

The existing 315kVA mini substation must be disconnected and transported to a destination of the contractor's choice.

Before the new 315kVA mini substation is installed, the ground must be compacted level and a precast concrete plinth must be hoisted onto the compacted area.

Once the concrete plinth is in position, then the mini sub can be hoisted onto the concrete plinth.

### **PSY7 400V MCC'S / DB'S CIRCUIT BREAKERS AND CONTACTORS**

The preferred Circuit Breakers and Contactors are Merlin Gerin and Telemecanique respectively or similar approved.

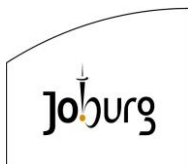
### **PSY8 LOW VOLTAGE MOTOR CONTROL CENTRES**

#### **a. SCOPE**

This specification covers the general technical requirements and the standards of equipment and materials in the design of Low Voltage Motor Control Centres (MCC's), where the voltage does not exceed 400 volts.

#### **b. REFERENCES**

Employer:		Contractor:	
Witness:		Witness:	



The construction of MCC's and the equipment therein, shall comply with Johannesburg Water's Particular Specification E04 Revision 6 (Electrical Low Voltage Distribution Boards and Motor Control Centres), and with the latest revisions and amendments of the relevant SABS, IEC and British Standards except that should any conflict occur, the requirements of this specification shall apply.

c. GENERAL

The design, construction and layout of the MCC's shall comply fully with the requirements of this specification and any Project Specification and or schematic drawings issued. Where conflict occurs, the requirements of the Project Specification and or drawings shall apply.

Each MCC shall be provided with an incoming feeder capable of carrying the connected load of the MCC, and each MCC shall be fully interlocked in the starting and tripping sequences.

The General Arrangements of each MCC and of a typical cubicle showing the equipment layout shall be approved by the Engineer, in writing, prior to manufacture, and all MCC's shall be inspected by the Engineer before delivery to site.

The Tenderer shall submit the following information with his Tender.

- General Arrangement drawings of each MCC, showing the internal equipment layouts, foundation details and approximate weight. All major dimensions shall be in millimetres.
- A schedule indicating the manufacture, type and rating of all the equipment being offered.

MCC's shall be so constructed that they may be split into smaller sections suitable for transportation, with each section being provided with eyebolts for lifting purposes.

Tenderers must pay particular attention to drawings 18056-73-12-152 and 18056-73-12-153. These drawings detail the HoW Module 1 MCC which consists of two panels that are connected by overhead busbar.

d. ENCLOSURE

Employer:		Contractor:	
Witness:		Witness:	



Motor Control Centres shall be the product of specialist manufacturers of this type of equipment. They shall be floor standing, bottom or top entry as specified in the Project Specification, dust, damp and vermin proof, multi-tier, industrial pattern and of multi-section construction. They shall be of folded heavy gauge 3CR12 sheet steel design, with a recessed plinth of channel or heavy gauge sheet steel angle section, the construction being such that the rigidity of the frame, doors and rear covers is adequate.

Sheet 3CR12 steel used in the construction of MCC's shall be a minimum of 2mm thickness, folded and braced as necessary to provide a rigid support for all components. Joints of any kind in steel metal work shall be seam welded, and all welding slag ground off and welding pits wiped clean with plumbers metal. All panel doors and covers shall be properly fitted and square within the frames. Holes in panels for fixing screws shall be accurately positioned to allow entry of screws without distortion of the panels. Only fixing screws of the correct length shall be used, the cutting to length of any screw once installed is not acceptable.

All cover fixings shall be by means of captive screws, dome nuts are not acceptable.

Sheet steel may be drilled and tapped to take fixing screws up to 6mm diameter. For screws or bolts of larger diameter, hank nuts shall be used. Self threading screws shall not be used in the construction of these boards.

After fabrication is complete, all metal work shall be derusted, degreased and painted inside and out with at least one coat of metal primer and two coats of epoxy based enamel. The interiors shall be finished white and the exterior shall be light orange (colour ref. 826 to SA8S 1091) unless otherwise stated in the Project Specification.

All doors and removable covers shall be rendered dust proof by means of suitable seals fixed to the frame. The IP rating of the MCC's shall be IP 42.

e. TYPE TWO CO-ORDINATION

Employer:		Contractor:	
Witness:		Witness:	



All starter drives must have protective / switching devices that are selected to be compliant to type 2 co-ordination (circuit breaker, contactor, overload relay, soft start or VSD).

f. SHORT CIRCUIT RATING

MCC's with a short circuit rating equal or greater than 10kA must comply with SANS 10142-1: 2003 Clause 6.6.5.

g. FUTURE FEEDERS

Space and mounting facilities shall be provided for future feeders equal to 20% of the number of feeders installed with a minimum of two future feeders.

## PSY9 EARTHING

The earthing of the transformers, mini substations and lightning protection of buildings must be undertaken by a specialist earthing vendor.

The specialist vendor must initially undertake a soil resistivity survey (Wenner Method) and determine the corrosiveness and resistivity of the soil. The results of this survey will ultimately determine the size of BCEW and the number of copper electrodes.

However, a guide that must be followed in regard to the earth conductor and earth spikes is as follows.

Earth conductor: 70mm<sup>2</sup> BCEW.

The earth conductor between the relevant earth electrode and the transformer must be 70mm<sup>2</sup> black insulated copper conductor.

Earth spikes: 16mm (OD) x 3 metre (L) mild steel, A grade copper coated electrodes.

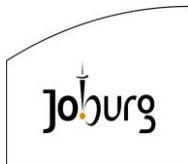
CAD welding must be used to connect the earth conductor to the earth spikes.

The final resistance of the earthing systems must be less than 1 ohm.

The specialist earthing vendor must issue a certificate of compliance (resistance test certificate) for the earthing systems.

The following specifications will apply.

Employer:		Contractor:	
Witness:		Witness:	



SANS 62305. 2007

SANS 10199. 2004

SANS 10313. 2008

SANS 10142-1 2003

The separate earth conductors installed alongside 600/1000V PVC/SWA/PVC cables must be BCEW.

### **PSY10 MEDIUM VOLTAGE CABLES & TERMINATIONS**

11kV PILC cables shall be constructed in accordance with SANS 97 table 18 (Belted 11/11kV).

Through joints shall not be permitted in cables of less than standard drum length. Where joints are deemed necessary, they shall be completed in one continuous operation.

All cables and through joints shall only be made by using terminating and jointing kits approved by the cable manufacturer, and by personnel trained by the manufacturer in the use of these kits. The manufacturer's instructions issued with the kits shall be strictly adhered to.

Each cable termination and or through joint shall be inspected by the Engineer or his representative prior to AC, LF pressure tests being carried out, the Engineer shall be notified timeously before any such tests are carried out.

The cables shall be firmly secured to there terminating switchgear or transformer by means of a clamp to obviate any stress on the cable or terminations. The copper tapes of the earth screen shall be bonded to the earth bar of the terminating equipment, but shall be removable for testing purposes.

The preferred MV termination & joint is Raychem or similar approved

### **PSY11 PVC/SWA/PVC AND PVC/PVC CABLES**

The Electrical Contractor shall supply, install, connect and test all the cables called for in the schedules and where shown on the drawings. Cables shall be 600/1000 volt grade, PVC insulated, steel wire armoured and PVC sheathed, with stranded copper conductors or as called for in the cable schedules, constructed in accordance with SABS 150. The armouring

Employer:		Contractor:	
Witness:		Witness:	



of any armoured cable is not acceptable as an earth conductor. Single core cables shall be un-armoured and run in trefoil formation.

All PVC/SWA/PVC or PVC/PVC cable terminations shall be Exe corrosion guard cable glands (IP68) similar and equal to those manufactured by "Pratley" or "CCG". Glands shall be complete with earthing ferrules, locknuts, bushes and shrouds.

Conductors shall be terminated onto equipment using compression lugs of the correct size and suitable for the application. Manual crimping shall be done with the Maker's special tools which will not release until the full crimping pressure has been achieved, the ends of conductors of 50mm<sup>2</sup> cross sectional area and greater shall be crimped by hydraulic machine.

Each and every run of cable shall be a single length without joints, save that where a run exceeds the standard drum length or where the length of cable is increased after installation, a through box will be permitted.

Cable joints shall be made by using kits approved by the cable manufacturer, and by personnel trained in the use of these kits. Tenderers shall specify in the appropriate schedule the type of cable joint to be used.

If epoxy resin filled boxes are to be used, preference will be given to transparent resin types. The type of joint used shall not impair the mechanical and electrical properties of the cables. All conductor and armouring wires shall be carried through the joint, and adequately crimped ferrules and lugs shall be used. The Engineer reserves the right to cut open any made joint to ensure the integrity of the joint, and should such an inspection reveal inadequate jointing procedures, the right to insist the re-jointing of all cables at the Electrical Contractor's expense. This applies to joints in all types of cable. Adequate measures shall be taken to prevent the ingress of moisture into any joint.

Drums of cable shall be delivered to site with their end seals intact and shall be off-loaded and stored in an approved manner. Any damaged cable shall be removed from site and replaced with undamaged cable at the Electrical Contractor's expense.

Employer:		Contractor:	
Witness:		Witness:	



Cable drums shall be supported on an axle and supporting jacks, and when the cable is unreeled, the direction of rotation indicated on the drum flanges shall be observed. Rolling of drums along the ground is not permitted.

#### **PSY12 CONTROL CABLES**

Control cables shall have a minimum cross section of 1.5mm<sup>2</sup> for each core. All cables shall be PVC/SWA/PVC 600/1000 volt type.

#### **PSY13 CABLE NUMBERING**

The contractor shall fit a cable number at each cable gland. The cable number shall be in accordance with the Johannesburg Water Specification. The cable numbers shall be equal to the type manufactured by Bowthorpe Hellerman or similar approved.

#### **PSY14 CABLE ROUTE MARKERS**

Approved concrete proprietary cable markers including a stainless steel plate that indicates the voltage and direction of the cable must be painted above all cable runs and bends.

The cable markers shall be supplied by the Contractor.

#### **PSY15 CABLE LADDERS**

Cable ladders shall be O-Line 3CR12 OL55 & 76 cable ladder or similar approved. All nuts and bolts must be stainless steel. Cable ladder must be duplex coated (exterior polyester) and the colour must be electric orange.

Wherever possible all cable racks shall be installed in a vertical orientation to prevent accumulation of spillage and dust. Adequate space being provided behind the rack for the fixing of nuts and cable ties, etc.

Cable racks shall be fixed to the building structure by means of stand-off supports at approximately two metre intervals, and also at the ends (joints) of each fabricated length. Supports shall be galvanised after fabrication.

Each run of cable rack shall be bonded across all sections and be electrically continuous throughout. Where the electrical continuity cannot be guaranteed, a continuous bare copper conductor shall be provided for each run of cable tray and each section shall be bonded to this conductor. In addition, all cable racks shall be bonded to the switchboard to which the cables it carries are connected.

Employer:		Contractor:	
Witness:		Witness:	



## PSY16 LAYING OF CABLES

When laying cables in trenches excavated in soft or hard rock or containing sharp stones, rocks or other items most likely to injure cables, the following precautions shall be taken:

- a. Before laying the cables all rocks, stones, etc shall be removed from the bottom of the trench. The floor of the trench shall be evenly covered with a layer of sifted backfill or sand to a level which is 100mm above the highest unevenness of the trench. The cost of this work shall be included in the contractor's price. The laying of cables shall not be commenced until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused, and must be adequately supported at short intervals during the entire operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed in an approved manner after drawing in of cables.
- b. The cable shall be covered with a 150mm layer of sifted backfill of sand. All trenches shall be backfilled with damp soil, in layers not more than 150mm thick. Each layer shall be individually compacted in order to obtain the same degree of permeability as that of the surrounding undisturbed soil.
- c. A distance of 300mm shall exist between instrumentation and power cable.

Tenderers are to note that:

Pickable Material -

Shall mean ground or rock that can be loosened by handpick and includes hard shale, compact outcrop and boulders from 75mm in diameter up to 0.03m<sup>2</sup> in volume.

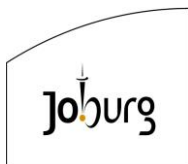
## PSY17 BATTERY TRIPPING UNIT

Six Battery Tripping Units will be required as part of the scope.

Substations 0, 1, 2, 3 & HoW substations will require Battery Tripping units rated at 30VDC-3A-10A/Hour. The units will each be supplied complete with a set of KPZ10, NiCad batteries, suitable to supply the continuous loads for all the control circuits of the 11kV panels.

The Blower Substation will require a Battery Tripping unit rated at 110VDC-10A-60A/Hour. The unit will be supplied complete with a set of L60P NiCad batteries, suitable to supply the continuous loads for all the control circuits of the 11kV panels. The BTU will also be suitable to trip all the relevant panels simultaneously in the case of an arc detection fault.

Employer:		Contractor:	
Witness:		Witness:	



The Blower Substation BTU must be equipped with an alarm card to indicate the following conditions.

- AC fail
- Low DC volts
- Charger off test

The BTU's must be in accordance with the following standards.

SANS 1652: 2004 Battery chargers – Industrial type (where applicable to the type of rectifier offered).

SANS 1632-1: 2005 Batteries Part 1: General information – Definitions, abbreviations and symbols.

SANS 1632-2: 2005 Vented – type stationary lead-acid cells and batteries.

SANS 1632-3: 2005 Batteries Part 3: Vented – type prismatic nickel-cadmium cells and batteries.

Johannesburg Water Specification.

The preferred BTU is that supplied by ACTOM Static Power or similar approved.

## **PSY18 LOCAL EMERGENCY STOP STATIONS**

Local emergency stop stations shall be installed next to motors.

These enclosures shall be manufactured from 3CR12 steel and powder coated with a protection rating of IP55.

The enclosure shall be equipped with a mushroom head emergency stop push button (push and latch / turn to release) with a protection rating of IP65.

The complete stop station shall have a protection rating of IP55 after all equipment and cables have been installed. The final colour shall be in accordance with the NOSA recommendations.

Support Steel Work (Local Stop / Start Stations).

The support steel work for local stop stations must be manufactured from PFC 100 x 50 x 6mm 3CR12 U channel. This vertical 1600mm U channel must be anchored to a 250 x 10mm 3CR12 base plate. The base plate must be strengthened by 8 x 100mm 3CR12 gusset plates. The entire frame must be coated with a polyester powder coating.

## **PSY19 LOCAL MOTOR ISOLATORS / STOP – START STATIONS**

Local motor isolators / stop – start stations shall be installed next to motors.

Employer:		Contractor:	
Witness:		Witness:	



These enclosures shall be manufactured from 3CR12 steel, polyester powder coated with a protection rating of IP65. The enclosure shall have a hinged door with a padlockable catch.

The enclosure shall be equipped with a motor type switch disconnecter of a suitable rating with an auxiliary contact. In addition, a start / push button and a mushroom head emergency stop push button (push and latch / turn to release) with a protection rating of IP65 shall be located on the side of the switch disconnecter enclosure. The switch disconnecter auxiliary contact and the emergency stop push button shall be connected in series. The motor switch disconnecter shall be operated via a vari depth handle with a protection rating of IP65. The complete switch disconnecter stop / start station shall have a protection rating of IP65 after all equipment and cables have been installed.

The switch disconnecter enclosure shall be corrosion protected in accordance with the standard specification. The final colour shall be in accordance with the NOSA recommendations.

The switch disconnecter enclosure shall be installed on support steelwork as described above under local emergency stop stations.

## **PSY20     LIMIT & PROXIMITY SWITCHES**

The preferred IP66, NO & NC, 6A, 230V AC limit switch is the ERSCE-E300-00-FM or similar approved.

The preferred 230V 200/300mA proximity switch is the Telemecanique XS1M30MA230 or similar approved.

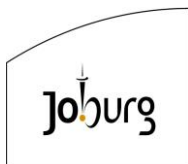
## **PSY21     LIGHTENING PROTECTION**

The electrical contractor must employ the services of a specialist lightning protection vendor to undertake the lightning protection of the various buildings. Drawings must be submitted to the Engineer for approval before the installation commences. Upon completion of the installation a certificate of compliance must be issued to the Engineer.

## **PSY22     LUMINAIRES**

All luminaires shall bear the SANS S mark and the specific SANS A mark.

Employer:		Contractor:	
Witness:		Witness:	



## PSY23 GENERATORS

### a. DEFINITIONS

In this specification, the term “alternator” shall mean an alternating current generating device for auxiliary electrical power supply to electrically driven equipment.

The term “generator set” shall refer to the combination of the alternator and its prime mover, which unless otherwise specified shall be a multi-cylinder, naturally aspirated, internal combustion, diesel-driven engine.

### b. STANDARDS

The following standards shall apply:

Johannesburg Water’s Particular Specification E14 Revision 4 (Electrical Supply and Installation of a Standby Generator ).

BS 2757: Classification of Insulating Material for Electrical Machinery

BS 5000: Machines for Miscellaneous Application (Part 99)

BS 5514: Specification for Reciprocating Internal Combustion Engines Performance

BS 4999: Alternator Protection (Part 20)

Temperature Rise (Part 32)

SABS 0140: Identification Colour Marking (Part 2)

In addition the provisions of the South African National Occupational Safety Association for colour coding of plant shall apply.

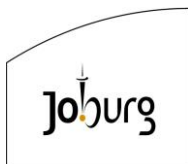
### c. SCOPE OF WORK

The project includes the complete supply, delivery, installation, testing and commissioning of a 600kVA, 400V indoor generator including automatic change over panel, day tank, bulk fuel tank, filling accessories, transfer pumps, sound attenuated exhaust and louvers and control cabling.

Complete supply, delivery, installation, testing and commissioning of a 150kVA, 400V standby emergency generator including fuel tank, weather proof & sound proof enclosure.

The outdoor position of the generator is indicated on drawing 18056-73-12-151.

Employer:		Contractor:	
Witness:		Witness:	



The generator will be connected to the Wash Water Pump Station MCC (See drawing 18056-73-12-133).

The Contractor will be responsible for the power and control cables between the generator and MCC.

Complete supply, delivery, installation, testing and commissioning of a 200kVA, 400V standby emergency generator including fuel tank, weather proof & sound proof enclosure.

The generator will be connected to the HoW New Blower Room MCC (See drawing 18056-73-12-127).

The Contractor will be responsible for the power and control cables between the generator and MCC.

#### d. IMPOSED LOAD

For calculation purposes a power factor of 0.8 and an efficiency of 94% shall be adopted.

Notwithstanding the specified nominal load capacity of the generator set, the complete set shall be capable of supplying both the transient and quiescent power requirements imposed by the equipment described in the Detail Specification within the voltage and frequency limits specified.

#### e. GENERATOR SET COMPONENTS

The Contractor shall provide all materials, equipment, labour and services necessary for the complete installation, testing, commissioning and the safe and efficient operation of the generator set as specified.

The work shall comprise of the complete generator set including (but not limited to) the following:

- Day / base tank, breather and filling accessories
- Supply of first fill of fuel and fuel for testing
- Exhaust and silencer system or other sound attenuation as required
- Control panel including gen-set controller
- Batteries and battery charger
- Mains failure sensing and change-over system
- Radiator cooling system
- Earthing

Employer:		Contractor:	
Witness:		Witness:	



- Remote alarms and contacts
- Interlocking voltage-free contacts
- Remote fuel level alarms
- Mains power for battery charger and engine auxiliaries
- Water heater for quick starting
- Anti-vibration skid base.
- Weather and sound proof enclosure
- Special tools required during execution of maintenance tasks
- Operator training
- Provision of Operation and Maintenance Manuals

f. DATA SHEET

Full technical detail of the generator set offered shall be submitted on the relevant Data Sheet included in the Tender Document.

g. DRAWINGS

Within four weeks of being awarded the Contract, the Contractor shall submit detailed drawings and wiring diagrams of the generator set and the switchgear, together with a detailed sequence of operations, to the Engineer for approval.

h. INSPECTION AND TESTING

During manufacture and before dispatch the Engineer may inspect the equipment at the manufacturer's works and subject it to such tests as may be necessary to establish compliance with the specifications. After installation, the equipment shall be tested to the satisfaction of the Engineer. The test shall be arranged by the Contractor who shall supply all necessary testing equipment.

Type test certificates for the current design of the alternator shall be submitted with the tender. Machines for which type test certificates are not available will not be accepted. Routine test certificates shall be submitted to the engineer prior to the final works test.

i. PAINTING

Painting of equipment shall be in accordance with SABS 0140 part 2 specification LEE P4A  
1.

j. NOTICES

Employer:		Contractor:	
Witness:		Witness:	



A clearly legible warning notice in English shall be mounted against the weather proof enclosure indicating that the engine will start without warning and that the selector should be switched to “off” before doing any work on the generator.

A notice with instructions in English regarding starting, shut-down and emergency procedures shall be mounted inside the enclosure.

**k. BASE MOUNTED FUEL TANK**

The generators must be manufactured with a base mounted day fuel tank.

The generator must be mounted above the day fuel tank.

**l. GUARANTEE**

Notwithstanding any delivery notes or documentation given by the Contractor or supplier to the contrary, the plant shall be subject to a 12-month maintenance period in accordance with the Contract. The Contractor shall replace free of charge any component that fails or shows evidence of defect during this period.

**PSY24 MOTORS**

Motors must have a minimum protection rating of IP55.

Four pole motors (1500rpm, frame size 225) that are 37kW and above must be fitted with thermistors.

Two pole motors (3000rpm, frame size 225) that are 45kW and above must be fitted with thermistors.

A total of three 155° Celsius thermistors must be fitted per motor.

One thermistor must be fitted per phase.

The thermistors must be wired in series and two conductors (red & blue) must be brought out of the motor and terminated in a motor terminal box.

The above is for motors with a standard insulation.

Thermistors must be wired to thermistor relays in the MCC starter cubicles and a digital input trip signal must be wired to the PLC.

**PSY25 TRASH SCREEN AT THE INLET CHANNEL**

The control panel for the Trash Screen at the inlet channel must have an IP rating of IP65, and the switchgear / PLC must be in accordance with this Electrical Project Specification and Johannesburg Water specifications.

Employer:		Contractor:	
Witness:		Witness:	



## **PSY26 LV OVERHEAD BUSBARS**

The layout of the LV overhead busbars is indicated on drawing 18056-73-12-152.

The busbars connect the HoW module one 315kVA transformer to the module 1 MCC.

The busbars also connect the two HoW module 1 MCC panels to each other.

Tenderers to note that the existing overhead busbars between the transformer and MCC has been vandalised, therefore, the existing will have to be removed and the new busbars installed.

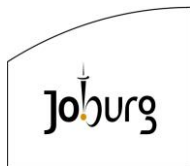
The preferred LV overhead busbar is the Telemecanique Canalis KG2 (800A – 1000A, 660V) Copper Busbar Trunking or similar approved.

## **PSY27 HOW MODULE 2 MOTOR STARTER DRIVES**

The HoW Module 2 MCC will be retained, however, as detailed in the bill of materials, existing switchgear and wiring from certain existing motor starter cubicles will be removed, and replaced with new wiring, cubicle doors, chassis plates and switchgear.

Furthermore, as detailed in the bill of materials, additional wiring, terminals & switchgear will be added to certain existing motor starter cubicles.

Employer:		Contractor:	
Witness:		Witness:	



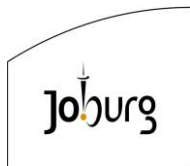
## PSY28 ELECTRICAL TECHNICAL DATA SCHEDULE

**TO BE COMPLETED BY THE TENDERER AND SUBMITTED AS PART OF HIS TENDER. IN THE EVENT OF THE TENDER BEING ACCEPTED THIS SCHEDULE OF MATERIAL OFFERED SHALL BE STRICTLY ADHERED TO.**

### 1. MV EQUIPMENT

	Description	Make	Part number	Supplier
1.1	RMU motorised 11kV 630A switch disconnecter.			
1.2	RMU motorised 11kV 630A vacuum circuit breaker.			
1.3	Umbilical cord including male socket and control station for RMU.			
1.4	30V DC 3A 10Ah battery tripping unit.			
1.5	Batteries for the 30V DC 3A BTU			
1.6	Protection relay for the RMU motorised 11kV 630A vacuum circuit breaker			
1.7	185mm <sup>2</sup> x 3 core, 11kV PILC copper cable to table 18.			

Employer:		Contractor:	
Witness:		Witness:	



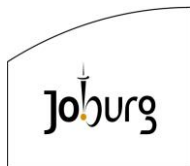
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Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
1.8	185mm <sup>2</sup> x 3 core, 11kV PILC copper cable joint.			
1.9	185mm <sup>2</sup> x 3 core, 11kV PILC copper cable internal termination.			
1.10	50mm <sup>2</sup> x 3 core, 11kV PILC copper cable to table 18.			
1.11	50mm <sup>2</sup> x 3 core, 11kV PILC copper cable joint.			
1.12	50mm <sup>2</sup> x 3 core, 11kV PILC copper cable internal termination.			
1.13	Metal clad 11kV 800A incomer vacuum spring actuated circuit breaker			
1.14	Metal clad 11kV 800A feeder vacuum spring actuated circuit breaker			
1.15	Metal clad 11kV 800A vacuum magnetic actuated circuit breaker			
1.16	11kV / 110V 200VA class 1 busbar VT panel.			
1.17	Umbilical cord including male socket and control station for spring & magnetic actuated circuit breakers			
1.18	110V DC 10A 60Ah battery tripping unit			

Employer:		Contractor:	
Witness:		Witness:	



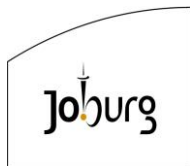
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Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
1.19	Batteries for the 110V DC 10A BTU			
1.20	315kVA mini substation			
1.21	315kVA mini substation precast plinth			

Employer:		Contractor:	
Witness:		Witness:	



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BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

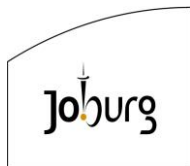


Volume 2A  
Part 3: Scope of Work

## 2. MCC & LOCAL CONTROL PANEL SWITCHGEAR

	Description	Make	Part number	Supplier
2.1	Motor Control Centre (MCC)			
2.2	MCC starter drives including cubicle door & chassis.			
2.3	Ammeter			
2.4	Voltmeter			
2.5	Voltmeter selector switch			
2.6	Power meter			
2.7	Relays			
2.8	Proximity relay			
2.9	Selector switch			
2.10	Push buttons			
2.11	Hour meter			

Employer:		Contractor:	
Witness:		Witness:	



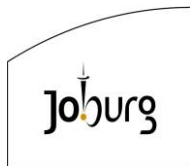
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Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
2.12	Contactors			
2.13	Overload			
2.14	2.2kW VSD as drawing 18056-73-12-131			
2.15	Power terminals			
2.16	Marshalling terminals			
2.17	Earth leakage unit			
2.18	Three phase isolators			
2.19	Three phase circuit breakers			
2.20	Single phase circuit breakers			
2.21	LED indication lamp			
2.22	Level relay			
2.23	Level probes			

Employer:		Contractor:	
Witness:		Witness:	



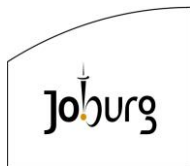
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Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
2.24	Float switch			
2.25	Emergency stop push buttons			
2.26	MCC room pressurising fan			
2.27	Outdoor filter for pressurising fan			
2.28	Outdoor cowl for pressurising fan			
2.29	Indoor louvre for pressurising fan			
2.30	IP65 skip control panel enclosure			
2.31	Local motor isolator / stop – start stations			
2.32	3CR12 support stands for the above item			
2.33	Isolators for the local motor isolator / stop – start stations.			
2.34	IP65 local emergency stop stations			
2.35	IP65 emergency stop – start push button station for the traversing conveyor			

Employer:		Contractor:	
Witness:		Witness:	



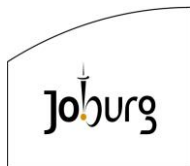
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BUSHKOPPIE WASTEWATER TREATMENT WORKS  
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Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
2.36	IP65 emergency stop, left & right push button station for the positioning of the traversing conveyor			
2.37	Torque relay			
2.38	400V 300A circuit breaker			
2.39	400V 300A motorised circuit breaker			
2.40	400V 630A motorised circuit breaker			
2.41	400V 630A air circuit breaker			

Employer:		Contractor:	
Witness:		Witness:	



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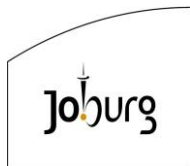


Volume 2A  
Part 3: Scope of Work

### 3. CABLES, CABLE ACCESSORIES AND AUX ITEMS.

	Description	Make	Part number	Supplier
3.1	PVC/SWA/PVC 1000V cables			
3.2	Exe corrosion guard cable glands for the above cable			
3.3	PVC warning tape.			
3.4	Cable route markers.			
3.5	Cable numbers			
3.6	Exe cable junction boxes			
3.7	3CR12 OL55 cable ladder			
3.8	3CR12 GS50 gridspan cable tray			
3.9	3CR12 OL76 cable ladder			
3.10.	Galvanised conduit			

Employer:		Contractor:	
Witness:		Witness:	



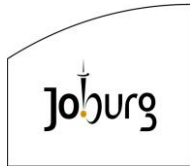
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INFRASTRUCTURE RENEWAL PLAN



Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
3.11	IP66, NO & NC, 6A, 230V AC limit switches including spring return roller lever			
3.12	230V, 200/300mA proximity switches			

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
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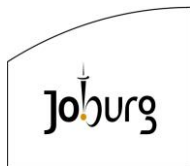
Volume 2A  
Part 3: Scope of Work



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#### 4. LIGHTING AND SMALL POWER.

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

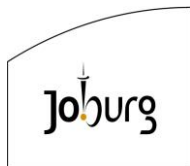


Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
4.1	B1 18W IP65 LED outdoor luminaire			
4.2	C1 1.2m 46W polycarbonate LED luminaire.			
4.3	C2 1.2m 46W polycarbonate LED emergency luminaire.			
4.4	3 phase 63A welding socket			
4.5	Surface 1 phase 16A switched socket outlet			
4.6	Surface 16A 1 lever 1 way switch			
4.7	Flush 1 phase 16A switched socket outlet			
4.8	Flush 16A 1 lever 1 way switch			
4.9	Photo cell			
4.10	20mm PVC conduit			
4.11	20mm galvanized conduit			
4.12	PVC insulated copper wire			

**5. LV OVERHEAD BUSBAR.**

Employer:		Contractor:	
Witness:		Witness:	



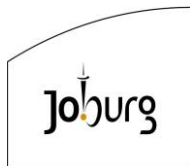
Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN



Volume 2A  
Part 3: Scope of Work

	Description	Make	Part number	Supplier
5.1	800 – 1000A, 660V copper busbar trunking.			
5.2	Transformer box.			
5.3	Set of flexibles.			
5.4	Transformer end feed unit.			
5.5	Elbow.			
5.6	Panel end feed unit.			

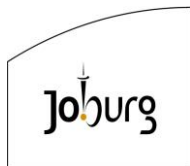
Employer:		Contractor:	
Witness:		Witness:	



## 6. STANDBY EMERGENCY GENERATOR.

	600kVA indoor generator description	Make	Part number	Supplier
6.1	Engine			
6.2	Alternator			
6.3	Electronic speed governor			
6.4	AVR (Automatic Voltage Regulator)			
6.5	Gen set controller			
6.6	Batteries			
6.7	Battery charger			
6.8	Automatic change over panel			
6.9	Motorised 400V 630A circuit breaker			
6.10	400V 630A circuit breaker			
6.11	Day tank			

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

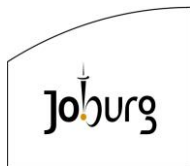


Volume 2A  
Part 3: Scope of Work

6.12	Bulk fuel tank			
6.13	Transfer pumps			
6.14	Radiator			
6.15	Sound attenuated exhaust			
6.16	Sound attenuated inlet louvre			
6.17	Sound attenuated outlet louvre			

	200kVA outdoor generator description	Make	Part number	Supplier
6.18	Engine			
6.19	Alternator			
6.20	Electronic speed governor			
6.21	AVR (Automatic Voltage Regulator)			
6.22	Gen set controller			

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN

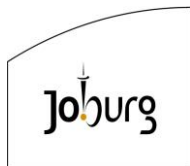


Volume 2A  
Part 3: Scope of Work

6.23	Batteries			
6.24	Battery charger			
6.25	Fuel tank			
6.26	Weather proof & sound proof enclosure			

	150kVA outdoor generator description	Make	Part number	Supplier
6.27	Engine			
6.28	Alternator			
6.29	Electronic speed governor			
6.30	AVR (Automatic Voltage Regulator)			
6.31	Gen set controller			
6.32	Batteries			
6.33	Battery charger			

Employer:		Contractor:	
Witness:		Witness:	



Contract: JW 14425  
BUSHKOPPIE WASTEWATER TREATMENT WORKS  
INFRASTRUCTURE RENEWAL PLAN



Volume 2A  
Part 3: Scope of Work

6.34	Fuel tank			
6.35	Weather proof & sound proof enclosure			

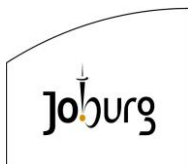
**7. ELECTRICAL CONTRACTOR.**

	Company name	Telephone Number	Project manager	Site Foreman
7.1				

**8. MOTOR CONTROL CENTRE.**

	Company / manufacturer's name	Telephone number
8.1		

Employer:		Contractor:	
Witness:		Witness:	



## PORTION 5: PARTICULARS OF REQUIRED CONTROL & INSTRUMENTATION WORK

### 1 SCOPE OF WORK

1.1. The scope of supply of the instrumentation part of this contract shall be the manufacturing, supply, delivery, safe storage on site before installation, installation and commissioning of the process monitoring and control instrumentation systems listed in this tender document and on the relevant drawings. The instrumentation equipment shall include the following:

- The supply, installation and commissioning of 15 level meters (1 hydrostatic pressure and 14 ultrasonic level).
- The supply, installation and commissioning of 14 flow meters (6 flume, 4 clamp-on, 3 weir and 1 magnetic flow meter).
- The supply, installation and commissioning of 4 pressure meters
- The supply, installation and commissioning of 1 pH meter
- The supply, installation and commissioning of 1 low level switch and 2 pressure switches
- The supply, installation and commissioning of IJBs for 38 motorised open/close valves
- The supply, installation and commissioning of IJBs for 2 motorised diverter gates
- The supply, installation and commissioning of IJBs for 38 motorised modulating valves
- The supply, installation and commissioning of IJBs for 36 solenoid valves
- The supply, installation and commissioning of instrument junction boxes (IJBs) for all instruments supplied (valves and penstocks are supplied and installed by others).
- The manufacture, supply and installation of support steel work for field junction boxes (FJBs) and instrument control panels (ICPs).
- The supply, delivery and installation of the PLC hardware as specified.
- The supply, delivery, installation, splicing and testing of fibre patch panels.

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Witness:		Witness:	



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- The supply, delivery, installation, splicing and termination of data communication fibre-optic cables.

**1.2.** The scope of work will further include the removal of all existing old cabling, old racking, old instrument panels and old junction boxes from the following areas.

- Unit 1 Head Of Works
- Lime Plant
- Wash Water Pump Station

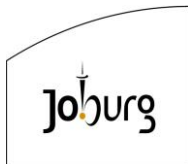
The cable block diagrams attached to this tender document for the Lime Plant and for the Wash Water Pump Station can be used to determine the cabling and equipment to be removed from these areas, because the old equipment will be removed and replaced with new equipment (i.e. similar quantities and sizes of cables, panels, etc.). The old equipment to be removed from Unit 1 Head Of Works however, must be viewed on site to enable the contractor to price for this work

**1.3.** The scope of work will also include the removal of existing PLC panels from the following areas:

- Unit 1 head of Works
- Lime Pant
- Wash Water Pump Station
- Dam01 (also known as the Emergency Dam)

**1.4.** The scope of work will also include the setting up and programming of two existing Siemens VSDs (Variable Speed Drives) for two 25kW Final Effluent centrifugal pumps. These pumps and VSDs were installed some time ago, but because the VSDs were never set up properly, the pumps continue having problems because they run at incorrect speeds.

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## 2 GENERAL

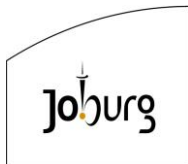
### 2.1 Drawings

#### 2.1.1 C&I Drawings Supplied

The following C&I drawings can be found in Volume 4 of this Tender.

Drawing Number	Description	Rev
<b>P&amp;IDs</b>		
46100563-WSP-DR-CI-PID00_T0-LEGEND	Legend Sheet for P&IDs	T1
46100563-WSP-DR-CI-PID01_T0-INFLOW	Inflow And Dam-01 P&ID	T1
46100563-WSP-DR-CI-PID02_T0-COARSE SCREENS	Unit 1 Coarse Screens P&ID	T1
46100563-WSP-DR-CI-PID03_T0-GRIT REMOVAL-MOD 1	Unit 1 Grit Removal P&ID	T1
46100563-WSP-DR-CI-PID04_T0-GRIT REMOVAL-MOD 2	Unit 2 Grit Removal P&ID	T1
46100563-WSP-DR-CI-PID05_T0-FINE SCREENS	Unit 1 Fine Screens P&ID	T1
46100563-WSP-DR-CI-PID06_T0-LIME DOSING	Lime Plant P&ID	T1
46100563-WSP-DR-CI-PID07_T0-WASH WATER PS	Wash Water Pump Station P&ID	T1
46100563-WSP-DR-CI-PID08_T0-EX WASH WATER PS	Final Effluent Wash Water Pump Station P&ID	T1
<b>TYPICAL LOOP DIAGRAMS</b>		
46100563-WSP-DR-CI -TYP-FCV001	Flow Control Valve FCV001 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-CLV001	Open/Close Valve CLV001 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-CLV001	Hand Valve HDV001 - Typical Loop Diagram	T1

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<b>Drawing Number</b>	<b>Description</b>	<b>Rev</b>
46100563-WSP-DR-CI -TYP-FIT001	Magflow Flow Meter - FIT001 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-FIT002	Area Velocity Flow Meter - FIT002 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-FIT003	Clamp On Flow Meter - FIT003 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-FIT004	Flume Flow Meter - FIT004 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-LIT001	Ultrasonic Level Transmitter - LIT001 - Typical Loop Diagram	T1
46100563-WSP-DR-CI -TYP-ICP-SLV001	Solenoid Instrument Control Panel SLV001 - Typical Loop Diagram	T1
<b>TYPICAL WIRING DIAGRAMS</b>		
46100563-WSP-DR-CI -TYP-D1R0S5-AI	PLC-TYP Remote Panel Analog Input Module Drop 1/Rack 0/Slot 5 - Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S2A-DI	PLC-TYP Digital Input Module: Sub-Base 1 of 4 Rack 0/Slot 2A Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S2B-DI	PLC-TYP Digital Input Module: Sub-Base 2 of 4 Rack 0/Slot 2B Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S2C-DI	PLC-TYP Digital Input Module: Sub-Base 3 of 4 Rack 0/Slot 2C Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S2D-DI	PLC-TYP Digital Input Module: Sub-Base 4 of 4 Rack 0/Slot 2D Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S3A-DO	PLC-TYP Digital Output Module: Sub-Base 1 of 2 Rack 0/Slot 3A (200-215) Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S3B-DO	PLC-TYP Digital Output Module: Sub-Base 2 of 2 Rack 0/Slot 3B (216-231) Typical Wiring Diagram	T1
46100563-WSP-DR-CI -TYP-R0S4-AI	PLC-TYP Analog Input Module: Rack 0/Slot 4 Typical Wiring Diagram	T1

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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Drawing Number	Description	Rev
46100563-WSP-DR-CI -TYP-R0S5-AO	PLC-TYP Analog Output Module: Rack 0/Slot 5 Typical Wiring Diagram	T1
<b>CABLE BLOCK DIAGRAMS</b>		
46100563-WSP-DR-CI-01-CBD001	Emergency Dam PLC-01 Control Room PLC-12 Cable Block Diagram	T1
46100563-WSP-DR-CI-03-CBD001	Wash Water Pump Station PLC-03 Cable Block Diagram	T1
46100563-WSP-DR-CI-10-CBD001	Unit 1 HOW PLC-10 Cable Block Diagram 1	T1
46100563-WSP-DR-CI-10-CBD002	Unit 1 HOW PLC-10 Cable Block Diagram 1	T1
46100563-WSP-DR-CI-11-CBD001	Unit 2 HOW PLC-11 Cable Block Diagram	T1
46100563-WSP-DR-CI-15-CBD001	Unit 2 HOW PLC-15 Cable Block Diagram	T1
<b>EQUIPMENT AND CABLE ROUTES</b>		
46100563-WSP-DR-CI-00-CT 0001	HOW Equipment and Cable Route Layout	T1
46100563-WSP-DR-CI-00-CT0002	Lime Plant, Wash Water, Final Effluent and Emergency Dam Equipment Layout and Cable Route	T1

Employer:		Contractor:	
Witness:		Witness:	



## 2.2 PLCs

### 2.2.1 PLC Hardware

There is one PLC (Head Of Works Unit 2) for which the PLC processor and some of the I/O cards must be replaced in the existing panel.

There are 4 PLCs for which complete new panels with PLC hardware, terminals, UPS, power supplies, surge protection, etc. must be supplied, installed and commissioned. They are:

- Head Of Works Unit 1
- Wash Water Pump Station
- Lime Plant
- Dam-01

There are two remote I/O panels, for which complete new panels with PLC hardware, terminals, UPS, power supplies, surge protection, etc. must be supplied, installed and commissioned. They are:

- Head Of Works Unit 2 new Blower House
- Final Effluent Wash Water Pump Station

### 2.2.2 PLC & Remote I/O Panels

The following PLC and Remote I/O panels are required under the scope of this project:

#### 2.2.2.1 Unit 1 HOW PLC (BK0110HOW01)

This PLC shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for). The PLC panel must be equipped with a true online UPS. Allow for a UPS bypass circuitry rated at 500A for 1000 milliseconds.

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The PLC hardware to be supplied under this contract for the UNIT 1  
HoW PLC is listed in the table below.

**Unit1 – Head Of Works (HoW)**

	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	3
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	3
<b>M580 Backplane Extensions</b>	BMXXBC015K	BACKPLANE EXTENSION CABLE 1.5M	2
	BMXXBE1000	STANDARD BACKPLANE EXTENDER (one in main rack and every extension rack)	3
	BMENOC0321	M580 NOC Control - Port forwarding	1
<b>M580 Digital Inputs</b>	BMXDDI6402K	DIG 64I 24 VDC SINK	7
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	6
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	3
	BMXAMO0410	ANA 4 U/I OUT ISOLATED	1
<b>M580 Accessories For D/O Relay sub-bases</b>	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	19
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	27
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	11
	BMXFTW308S	Fly leads for BMXAMI0810 card	3
	BMXFTB2010	Screw Terminal 20-way for BMXAMO0410	1
	TSXTLYEX	BusX Terminators (Qty 2)	1
	BMXXEM010	X80 Free Slot Covers	1
		UPS	1

Employer:		Contractor:	
Witness:		Witness:	



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### 2.2.2.2 Unit 2 HoW PLC (BK0211HoW02)

This PLC is an existing PLC with Schneider Premium hardware. All the existing hardware in the PLC racks must be removed and handed to the client as spares for other Premium PLCs on this site. The new hardware listed below must be supplied, installed in the existing panels, wired, tested and commissioned. The PLC panel must be equipped with a true online UPS. Allow for a UPS bypass circuitry rated at 500A for 1000 milliseconds.

The PLC hardware to be supplied under this contract for the UNIT 2 HoW PLC is listed in the table below.

#### Unit2 – Head Of Works (HoW)

	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	5
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
	BMEXBP1200	12 SLOTS BACKPLANE	4
<b>M580 Backplane Extensions</b>	BMXXBC015K	BACKPLANE EXTENSION CABLE 1.5M	4
	BMXXBE1000	STANDARD BACKPLANE EXTENDER (one in main rack and every extension rack)	5
	BMXCRA31210	X80 RIO Drop E/IP Perf	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMENOC0321	M580 NOC Control - Port forwarding	1
<b>M580 Digital Inputs</b>	BMXDAI1615	DIG 16X1 SUPERVISED IN 200 TO 240 VAC	25
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	6
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	1
	BMXFTW308S	Fly leads for BMXAMI0810 card	1

Employer:		Contractor:	
Witness:		Witness:	



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	<b>Reference</b>	<b>Description</b>	<b>Qty</b>
<b>For 16xD/I Cards (40-pin pre-wired &amp; fly leads)</b>	BMXFTW305	3 Meter connecting cable for DAI1615 (40 Fly leads)	13
<b>For 16xD/I Cards (40-pin pre-wired &amp; fly leads)</b>	BMXFTW505	5 Meter connecting cable for DAI1615 (40 Fly leads)	13
	TSXTLYEX	BusX Terminators (Qty 2)	1
	BMXXEM010	X80 Free Slot Covers	6
		UPS	1

#### 2.2.2.1 Unit 2 HoW BLOWERS REMOTE I/O (BK0211HoW02)

This Remote I/O shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for).

The PLC hardware to be supplied under this contract for the UNIT 2 HoW BLOWERS REMOTE I/O is listed in the table below.

#### Unit2 – Head Of Works (HoW) Blowers Remote I/O

	<b>Reference</b>	<b>Description</b>	<b>Qty</b>
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
	BMXCRA31210	X80 RIO Drop E/IP Perf	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMXDDI6402K	DIG 64I 24 VDC SINK	1
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1

Employer:		Contractor:	
Witness:		Witness:	



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	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	1
	BMXAMO0410	ANA 4 U/I OUT ISOLATED	1
<b>For D/O relay sub-bases.</b>	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	3
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	4
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	2
	BMXFTW308S	Fly leads for BMXAMI0810 card	1
	BMXFTB2010	Screw Terminal 20-way for BMXAMO0410	1
	TSXTLYEX	BusX Terminators (Qty 2)	1
	BMXXEM010	X80 Free Slot Covers	6

#### 2.2.2.2 WASH WATER PUMP STATION (BK0103WPS01)

This PLC shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for). The PLC panel must be equipped with a true online UPS. Allow for a UPS bypass circuitry rated at 500A for 1000 milliseconds. The PLC hardware to be supplied under this contract for the WASH WATER PUMP STATION PLC is listed in the table below.

#### Wash Water Pump Station

	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1

Employer:		Contractor:	
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<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMENOC0321	M580 NOC Control - Port forwarding	1
<b>M580 Digital Inputs</b>	BMXDDI6402K	DIG 64I 24 VDC SINK	2
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	1
	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	5
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	8
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	2
	BMXFTW308S	Fly leads for BMXAMI0810 card	1
	TSXTLYEX	BusX Terminators (Qty 2)	1
		UPS	1

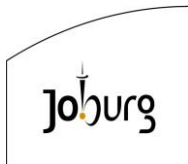
**2.2.2.3 Final Effluent Wash Water Pump Station Remote I/O  
(BK0103WPS01)**

This Remote I/O shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for).

The PLC hardware to be supplied under this contract for the FINAL EFFLUENT WASH WATER PUMP STATION REMOTE I/O is listed in the table below.

**Final Effluent Wash Water Pump Station Remote I/O**

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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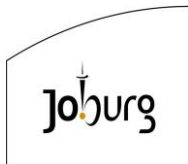
	<b>Reference</b>	<b>Description</b>	<b>Qty</b>
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
	BMXCRA31210	X80 RIO Drop E/IP Perf	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMXDDI6402K	DIG 64I 24 VDC SINK	1
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	1
<b>For D/O relay sub-bases.</b>	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	3
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	4
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	2
	BMXFTW308S	Fly leads for BMXAMI0810 card	1
	TSXTLYEX	BusX Terminators (Qty 2)	1
	BMXXEM010	X80 Free Slot Covers	6

#### 2.2.2.4 LIME PLANT PLC (BK0115LIM01)

This PLC shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for). The PLC panel must be equipped with a true online UPS. Allow for a UPS bypass circuitry rated at 500A for 1000 milliseconds. The PLC hardware to be supplied under this contract for the LIME PLANT PLC is listed in the table below.

#### Lime Plant

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1
	BMEXBP1200	12 SLOTS BACKPLANE	1
	BMENOC0321	M580 NOC Control - Port forwarding	1
<b>M580 Digital Inputs</b>	BMXDDI6402k	DIG 64I 24 VDC SINK	2
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	2
	BMXAMO0410	ANA 4 U/I OUT ISOLATED	1
<b>M580 Accessories</b>	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	4
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	7
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	2
	BMXFTW308S	Fly leads for BMXAMI0810 card	2
	BMXFCC301	FCN TO 1 HE 3M CONNECTING CABLE	1
	BMXFTB2010	Screw Terminal 20-way for BMXAMO0410	1
	BMXXEM010	X80 Free Slot Covers	1
		UPS	1

#### 2.2.2.5 DAM-01 PLC (BK0101DAM01)

This PLC shall be complete with a floor-standing, bottom-entry enclosure, 24V DC power supplies, circuit breakers, surge protection, UPS, etc. and wired to the relevant I/O. The Contractor shall ensure that there is sufficient space for all terminals, fused terminals, circuit breakers, surge protection, etc. There shall also be sufficient space to ensure that all spare cards can be equipped and wired in future if required (refer to PLC schematic to find what future cards must be allowed for). The PLC panel must be equipped with a true online UPS. Allow for a UPS bypass circuitry rated at 500A for 1000 milliseconds.

Employer:		Contractor:	
Witness:		Witness:	



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The PLC hardware to be supplied under this contract for the DAM-01 PLC is listed in the table below.

**Dam-01**

	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMENOC0321	M580 NOC Control - Port forwarding	1
<b>M580 Digital Inputs</b>	BMXDDI6402k	DIG 64I 24 VDC SINK	1
<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1
<b>M580 Accessories</b>	BMXFCC303	FCN TO 2 HE (1x40-way to 2x10 HE Connectors)3M CONNECTING CABLE	2
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	2
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	1
	BMXDAI1615	DIG 16X1 SUPERVISED IN 200 TO 240 VAC	1
	BMXFTW305	3 Meter connecting cable for DAI1615 (40 Fly leads)	1
		UPS	1

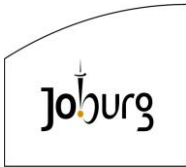
## 2.3 Documentation

### 1.3.1 Hardware supply

User manuals - for all equipment supplied by the Contractor must be included in the documentation.

Three copies of all documentation must be provided.

Employer:		Contractor:	
Witness:		Witness:	



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### 1.3.2 Shop Drawings

Before Panel manufacturing (for PLCs and Remote I/O) or IJB and ICP manufacturing can start, the successful tenderer must submit detailed panel layout drawings for approval by the Employer's Agent.

### 2.4 Recommended Spares

The Contractor must quote on a recommended spares list to be approved by the Employer's Agent.

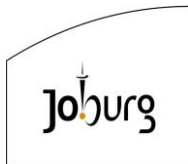
## 3 FIELD EQUIPMENT

### 3.1 Instrumentation

#### 3.1.1 Instrument Lists

Instruments required for this scope of work are indicated in the tables below.

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Witness:		Witness:	



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<b>Unit 1 HoW PLC (BK0110HoW01)</b>			
<b>Item</b>	<b>Description</b>	<b>Tag name</b>	<b>TYPE</b>
1	Units 1 & 2 Inflow	10-FIT001	Flow meter - Flume
2	Unit 1 Inflow	10-FIT002	Flow meter - Flume
3	Course Screens U/S Level	10-LIT002	Ultrasonic Level
4	Coarse Screens Washer 1 Level	10-LIT004	Pressure Meter
5	Coarse Screens Washer 1 Indication	10-IND001	Indication Station
6	Coarse Screens Washer 2 Level	10-LIT005	Pressure Meter
7	Coarse Screens Washer 2 Indication	10-IND002	Indication Station
8	Unit 1 Wash Water Storage Tank Level	10-LIT003	Ultrasonic Level
9	Unit 1 Wash Water Storage Tank Level Switch	10-LSL001	Level Low Switch
10	Unit 1 Wash Water Pumps Flow	10-FIT003	Flow meter - Clamp on
11	Compressor Reciever High Pressure	10-PSH001	Pressure Switch High
12	Compressor Reciever Low Pressure	10-PSL001	Pressure Switch Low
13	Fine Screen 1 Upstream Level	10-LIT006	Ultrasonic Level
14	Fine Screen 2 Upstream Level	10-LIT007	Ultrasonic Level
15	Fine Screen 3 Upstream Level	10-LIT008	Ultrasonic Level
16	Fine Screen 4 Upstream Level	10-LIT009	Ultrasonic Level
17	Fine Screens Washer 1 Level	10-LIT010	Pressure Meter
18	Fine Screens Washer 1 Indication	10-IND003	Indication Station
19	Fine Screens Washer 2 Level	10-LIT011	Pressure Meter
20	Fine Screens Washer 2 Indication	10-IND004	Indication Station
21	Macerator Pumps Sump Level	10-LIT012	Ultrasonic Level
22	Grit Classifier/Washer 1 Pressure Transmitter	10-PIT001	Pressure Meter
23	Grit Classifier/Washer 2 Pressure Transmitter	10-PIT002	Pressure Meter

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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**NOTE:** The following items from the list above will be supplied and installed by others. These items therefore need not be supplied by the contractor. **Items 4, 6, 11, 12, 17, 19, 12, 22 and 23.** The contractor must however manufacture, supply, install, test and commission a new field IJB for each of these items.

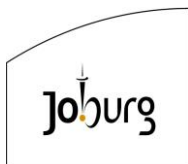
Unit 2 HoW PLC & REMOTE I/O (BK0111HoW02)			
Item	Description	Tag name	TYPE
1	Degritter Washer/Classifier 1 Pressure	11-PIT001	Pressure Meter
2	Degritter Washer/Classifier 2 Pressure	11-PIT002	Pressure Meter
3	Trash Screens U/S Level	11-LIT002	Ultrasonic Level
4	Unit 2 Wash Water Pumps Flow	11-FIT002	Flow meter - Clamp on
5	Compressor Reciever High Pressure	11-PSH001	Pressure Switch High
6	Compressor Reciever Low Pressure	11-PSL001	Pressure Switch Low

**NOTE:** The following items from the list above will be supplied and installed by others. These items therefore need not be supplied by the contractor. **Items 1,2, 5 and 6.** The contractor must however manufacture, supply, install, test and commission a new field

IJB for each of these items.

Unit 1 WASH WATER & FINAL EFFLUENT WASH WATER PUMP STATION PLC & REMOTE I/O(BK0103WPS01)			
Item	Description	Tag name	TYPE
1	WWPS Filtered Effluent To HoW Flow	03-FIT001	Flow meter - Magflow
2	WWPS Filtered Effluent To Filters Flow	03-FIT002	Flow meter - Clamp on
3	FEFF Filtered Effluent To Filters Flow	03-FIT003	Flow meter - Clamp on

Employer:		Contractor:	
Witness:		Witness:	



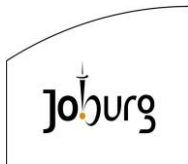
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Unit 1 LIME PLC (BK0115LIM01)			
Item	Description	Tag name	TYPE
1	Lime Silo Load Cell	15-WIT001	Load Cell
2	Reaction Tank Overflow pH	15-AIT001	pH Analyser
3	Reaction Tank Overflow Temp	15-TIT001	Temperature transmitter
4	Lime Make-Up Tank 1 Level	15-LIT001	Ultrasonic Level
5	Lime Make-Up Tank 2 Level	15-LIT002	Ultrasonic Level
6	Reaction Tank 1 Discharge	15-FIT003	Flow Meter - Weir
7	Reaction Tank 2 Discharge	15-FIT004	Flow Meter - Weir

**NOTE:** The load cell in item 1 of the list above need not be supplied by the contractor. There is an existing load cell that must be re-used. The contractor must however manufacture, supply, install, test and commission a new field IJB for this load cell.

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Witness:		Witness:	



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Unit 1 DAM01 PLC (BK0101DAM01)			
Item	Description	Tag name	TYPE
1	Dam Level	01-PIT001	Pressure Indicator
2	Dam Overflow	01-FIT001	Flow Meter - Weir

Unit 1 CONTROL ROOM PLC (BK0112ADM00)			
Item	Description	Tag name	TYPE
1	Reactor 1 Inflow	01-FIT012	Flow meter - Flume
2	Reactor 2 Inflow	01-FIT013	Flow meter - Flume
3	Reactor 3 Inflow	01-FIT014	Flow meter - Flume
4	Reactor 4 Inflow	01-FIT015	Flow meter - Flume

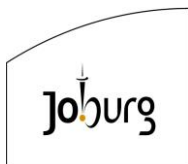
**NOTE:** These (i.e. flow meters connected to the Control Room PLC), are existing flow meters and IJBs (Instrument Junction Boxes). These instruments and IJBs must be replaced with new equipment and connected to the existing cables running to the Control Room PLC. No trenching or cable racking will be required here.

### 3.1.2 Lists For Valves, Penstocks, Solenoids And Diverters

The actual **valves, solenoids, penstocks and diverter gates** indicated in the tables below will be supplied and installed by others. Valve ICPs (Instrument Control Panels) and terminal boxes required for this scope of work are as follows:

- Each modulating valve, each open/close valve and each diverter gate must be equipped with an ICP.
- Each solenoid valve must be equipped with a Terminal Box (see item 3.1.4 below).

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<b>Unit 1 HoW PLC (BK0110HoW01)</b>			
<b>Item</b>	<b>Description</b>	<b>Tag name</b>	<b>TYPE</b>
1	Unit 1 Inlet Valve	10-FCV001	Modulating valve
2	Course Screen1 U/S Penstock	10-CLV001	Open-close valve
3	Course Screen2 U/S Penstock	10-CLV002	Open-close valve
4	Course Screen1 D/S Penstock	10-CLV003	Open-close valve
5	Course Screen2 D/S Penstock	10-CLV004	Open-close valve
6	Coarse Screen 1 Wash Water Solenoid	10-SLV001	Solenoid Valve
7	Coarse Screen 1 Hydro Conveyance Solenoid.	10-SLV002	Solenoid Valve
8	Coarse Screen 2 Wash Water Solenoid	10-SLV003	Solenoid Valve
9	Coarse Screen 2 Hydro Conveyance Solenoid.	10-SLV004	Solenoid Valve
10	Coarse Screens Diverter Gate	10-DVG001	Diverter Gate
11	Coarse Screens Washer 1 WW Solenoid	10-SLV005	Solenoid Valve
12	Coarse Screens Washer 1 Outlet Valve	10-CLV005	Open-close valve
13	CS Washer 1 Launder Water Solenoid	10-SLV006	Solenoid Valve
14	CS Washer 1 Trough Water Solenoid	10-SLV007	Solenoid Valve
15	Coarse Screens Washer 2 WW Solenoid	10-SLV008	Solenoid Valve
16	Coarse Screens Washer 2 Outlet Valve	10-CLV006	Open-close valve
17	CS Washer 2 Launder Water Solenoid	10-SLV009	Solenoid Valve
18	CS Washer 2 Trough Water Solenoid	10-SLV010	Solenoid Valve
19	Degritter1 Fluidise Valve	10-SLV011	Solenoid Valve
20	Degritter2 Fluidise Valve	10-SLV012	Solenoid Valve
21	Degritter3 Fluidise Valve	10-SLV013	Solenoid Valve
22	Degritter4 Fluidise Valve	10-SLV014	Solenoid Valve
23	Fine Screen 1 Upstream Penstock	10-CLV007	Open-close valve

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<b>Unit 1 HoW PLC (BK0110HoW01)</b>			
24	Fine Screen 2 Upstream Penstock	10-CLV008	Open-close valve
25	Fine Screen 3 Upstream Penstock	10-CLV009	Open-close valve
26	Fine Screen 4 Upstream Penstock	10-CLV010	Open-close valve
27	Fine Screen 1 Downstream Penstock	10-CLV011	Open-close valve
28	Fine Screen 2 Downstream Penstock	10-CLV012	Open-close valve
29	30Fine Screen 3 Downstream Penstock	10-CLV013	Open-close valve
30	Fin31e Screen 4 Downstream Penstock	10-CLV014	Open-close valve
31	Fine Screen 1 Wash Water Solenoid	10-SLV023	Solenoid Valve
32	Fine Screen 1 Hydro Conveyance Solenoid.	10-SLV024	Solenoid Valve
33	Fine Screen 2 Wash Water Solenoid	10-SLV025	Solenoid Valve
34	Fine Screen 2 Hydro Conveyance Solenoid.	10-SLV026	Solenoid Valve
35	Fine Screen 3 Wash Water Solenoid	10-SLV027	Solenoid Valve
36	Fine Screen 3 Hydro Conveyance Solenoid.	10-SLV028	Solenoid Valve
37	Fine Screen 4 Wash Water Solenoid	10-SLV029	Solenoid Valve
38	Fine Screen 4 Hydro Conveyance Solenoid.	10-SLV030	Solenoid Valve
39	Fine Screens Diverter Gate	10-DVG002	Diverter Gate
40	Fine Screens Washer 1 WW Solenoid	10-SLV031	Solenoid Valve
41	Fine Screens Washer 1 Outlet Valve	10-CLV015	Open-close valve
42	FS Washer 1 Launder Water Solenoid	10-SLV032	Solenoid Valve
43	FS Washer 1 Trough Water Solenoid	10-SLV033	Solenoid Valve
44	Fine Screens Washer 2 WW Solenoid	10-SLV034	Solenoid Valve
45	Fine Screens Washer 2 Outlet Valve	10-CLV016	Open-close valve
46	FS Washer 2 Launder Water Solenoid	10-SLV035	Solenoid Valve

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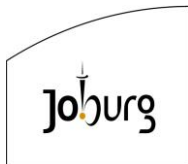


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Unit 1 HoW PLC (BK0110HoW01)			
47	FS Washer 2 Trough Water Solenoid	10-SLV036	Solenoid Valve
48	Grit Classifier/Washer 1 Inlet Valve	10-CLV017	Open-close valve
49	Grit Classifier/Washer 2 Inlet Valve	10-CLV018	Open-close valve

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<b>Unit 2 HOW PLC (BK0111HOW02)</b>			
<b>Item</b>	<b>Description</b>	<b>Tag name</b>	<b>TYPE</b>
1	Degritter Washer/Classifier 1 Inlet Valve	11-CLV033	Open-close valve
2	Degritter Washer/Classifier 2 Inlet Valve	11-CLV034	Open-close valve
3	Degritter 1 Fluidise Valve	11-SLV001	Solenoid Valve
4	Degritter 2 Fluidise Valve	11-SLV002	Solenoid Valve
5	Degritter 3 Fluidise Valve	11-SLV003	Solenoid Valve
6	Degritter 4 Fluidise Valve	11-SLV004	Solenoid Valve
<b>Unit 1 WASH WATER &amp; FINAL EFFLUENT WASH WATER PUMP STATION PLC &amp; REMOTE I/O(BK0103WPS01)</b>			
<b>Item</b>	<b>Description</b>	<b>Tag name</b>	<b>TYPE</b>
1	WWPS Filter 1 Discharge Valve	03-CLV001	Open-close valve
2	WWPS Filter 1 Inlet Valve	03-CLV002	Open-close valve
3	WWPS Filter 2 Discharge Valve	03-CLV003	Open-close valve
4	WWPS Filter 2 Inlet Valve	03-CLV004	Open-close valve
5	WWPS Filter 3 Discharge Valve	03-CLV005	Open-close valve
6	WWPS Filter 3 Inlet Valve	03-CLV006	Open-close valve
7	WWPS Filter 4 Discharge Valve	03-CLV007	Open-close valve
8	WWPS Filter 4 Inlet Valve	03-CLV008	Open-close valve
9	WWPS Filtered Effluent Discharge Valve	03-CLV009	Open-close valve
10	FEFF Filter 1 Discharge Valve	03-CLV010	Open-close valve
11	FEFF Filter 1 Inlet Valve	03-CLV011	Open-close valve
12	FEFF Filter 2 Discharge Valve	03-CLV012	Open-close valve
13	FEFF Filter 2 Inlet Valve	03-CLV013	Open-close valve
14	FEFF Filter 3 Discharge Valve	03-CLV014	Open-close valve
15	FEFF Filter 3 Inlet Valve	03-CLV015	Open-close valve
16	FEFF Filter 4 Discharge Valve	03-CLV016	Open-close valve

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



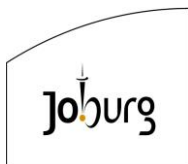
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17	FEFF Filter 4 Inlet Valve	03-CLV017	Open-close valve
18	FEFF Filtered Effluent Discharge Valve	03-CLV018	Open-close valve

Unit 1 LIME PLC (BK0115LIM01)			
Item	Description	Tag name	TYPE
1	Slurry Bowl 1 Water Solenoid	15-SLV001	Solenoid Valve
2	Slurry Bowl 2 Water Solenoid	15-SLV002	Solenoid Valve
3	Lime Silo Agitator Solenoid 1	15-SLV003	Solenoid Valve
4	Lime Silo Agitator Solenoid 2	15-SLV004	Solenoid Valve
5	Lime Make-Up Tank 1 Disch Valve	15-FCV001	Modulating valve
6	Lime Make-Up Tank 2 Disch Valve	15-FCV002	Modulating valve

Employer:		Contractor:	
Witness:		Witness:	



### **3.1.3 Requirements For Field Instruments**

#### **3.1.3.1 Flow Meters**

All flow meters must comply with the requirements in the “Automation and Control Standards, Volume 8, Flow Measurement” (Rev.18).

#### **3.1.3.2 Level Meters**

All level meters must comply with the requirements in the “Automation and Control Standards, Volume 9, Level Measurement” (Rev.14).

#### **3.1.3.3 Pressure Meters**

All pressure meters must comply with the requirements in the “Automation and Control Standards, Volume 23, Pressure Measurement” (Rev.8).

#### **3.1.3.4 pH Meters**

All pH meters must comply with the requirements in the “Automation and Control Standards, Volume 9, Level Measurement” (Rev.14).

#### **3.1.3.5 Indication Stations**

Indication stations are steel boxes (like the IJBs or ICPs) equipped with several indicating lamps and labels on the front of the panel. Inside will be terminals and an earth bar. All indication stations must comply with the relevant requirements in the “Automation and Control Standards, Volume 19, Field Junction Boxes” (Rev.19) and the “Automation and Control Standards, Volume 25, Labelling” (Rev.3).

### **3.1.4 Requirements For Field IJBs And ICPs**

- All instruments and valves (except individual solenoid valves as explained below) must be equipped with an IJB (Instrument Junction Box) or ICP (instrument Control Panel).
- IJBs and ICPs must comply with the requirements in the “Automation and Control Standards, Volume 19, Field Junction Boxes” (Rev.19), “Automation and Control Standards, Volume 5, Clean Power And Surge Protection” (Rev. 14) and “Automation and Control Standards, Volume 25, Labelling” (Rev.3).

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- **NOTE:** The IJBs and ICPs are priced separately from the instruments in the BOQ.
- For solenoid valves, where the cable block diagrams indicate “Terminal Box” it means that a metal IJB is not required. Instead, a Pratley or CCG type terminal box, equipped with link terminals for isolation and fuse terminals for protection, must be supplied and installed. The BOQ will also refer to these as “Terminal Boxes”, instead of ICPs or IJBs.
- For level and pressure **Switches** (i.e. not analogue transmitters), where the cable block diagrams indicate “Terminal Box” it means that a metal IJB is not required. Instead, a Pratley or CCG type terminal box, equipped with link terminals for isolation and fuse terminals for protection, must be supplied and installed. The BOQ will also refer to these as “Terminal Boxes”, instead of ICPs or IJBs.

### 3.1.5 Requirements For Cabling, Racking And Trenching

- All cabling, racking and trenching must comply with the requirements in the “Automation and Control Standards, Volume 6, Cabling” (Rev.17) and “Automation and Control Standards, Volume 25, Labelling” (Rev.3).
- All cabling must be priced in the BOQ for “Supply & Deliver” cost, “Installation, Testing & Commissioning” cost and “Termination” cost.
- All trenching will be done in pickable soil. I.e. the use of picks and shovels will suffice and there will be no requirement for jack hammers, blasting, etc. The cost in the BOQ (Bill Of Quantities) for trenching must include the trenching, supply and installation of sifted sand, the supply and installation of protective tiles, the supply and installation of danger tape, backfilling of the trench and rehabilitation of the areas where trenching was done.
- **NOTE:** Where there are road crossings, cable sleeves and special mechanical protection is required (see the “Automation and Control

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Standards, Volume 6, Cabling” (Rev.17)” specification). Pricing for cabling must include this cost where applicable.

- There are areas at Units 1 & 2 Head O Works where there are existing trenches (approximately 1m wide) under concrete slabs. In the BOQ this will be indicated as “Trenching under slabs”. The contractor must allow a cost per meter to lift the slabs and to replace them again after cable installation has been done.
- Before purchasing any protective tiles, the contractor must submit examples of the proposed tiles to the engineer for approval.
- NOTE: All instrumentation cables (that includes the power supply cables to instrument transmitters), must have an **ORANGE** outer sheath.
- The Bill Of Quantities will indicate required lengths and sizes of cable and racking. Sizes and quantities indicated in the Bill Of Quantities are there to ensure sufficient funds are available for cables and racking. These quantities must not be used for placing of orders. The Contractor must submit cable racking layouts for approval by the Employer’s Agent before any racking is ordered. The contractor must also confirm actual cable lengths before orders are placed.
- Where the BOQ refers to “Terminate”, this price must include all labour, testing and consumables. The quantity for this “Terminate” is regarded as the number of cables for which the cost (labour and consumables) must be allowed to terminate the two (2) ends of that cable. E.g. a quantity of 8 means 8 cables, each with two ends to be terminated (i.e. 16 ends in total).

### 3.1.6 Requirements For Cable Route Markers

- All cable route markers must comply with the requirements in the “Automation and Control Standards, Volume 6, Cabling” (Rev.17).
- Before purchasing any cable route markers, the contractor must submit examples of the proposed cable route markers to the engineer for approval.

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Witness:		Witness:	



### 3.1.7 Requirements For PLC And Remote I/O Panels

All new PLC panels, new remote I/O panels and modifications to existing PLC panels must comply with the following Johannesburg Water “Automation and Control Standards”:

- PLC Panels, Volume 3 (Rev. 15)
- Clean Power And Surge Protection, Volume 5 (Rev. 14) (this includes UPS requirements).
- Cabling, Volume 6 (Rev. 17)
- Networking, Volume 7 (Rev. 15)
- Labelling, Volume 25 (Rev. 3)

### 3.1.8 Data Communication And Networking

The networking hardware listed in the table below as well as the associated fibre-optic cable mentioned below, must be supplied and installed. The cost of this equipment must be included in the relevant PLC cost in the BOQ. Drawings 46100563-WSP-DR-CI-03-CBD001\_T0-AI and 46100563-WSP-DR-CI-11-CBD001\_T0-AI show the detailed requirements for this equipment.

PLC Name	Description	QTY
Wash Water Pump Station	LC Connector Patch Panel	1
Final Effluent Wash Water Pump Station Remote I/O	LC Connector Patch Panel	1
Unit 2 New Blower House Remote I/O	LC Connector Patch Panel	1
Unit 2 Head Of Works Existing PLC Panel	LC Connector Patch Panel	1

A 6 Pair, PVC, SWA, single mode fibre-optic cable must be installed between the Wash Water Pump Station PLC panel and the Final Effluent Wash Water Pump Station Remote I/O panel. This cable must be terminated in 2 of the patch panels shown in the table above.

A 6 Pair, PVC, SWA, single mode fibre-optic cable must be installed between the existing Unit 2 Head Of Works PLC panel and the new Unit 2 Blower House Remote

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I/O panel. This cable must be terminated in 2 of the patch panels shown in the table above.

The Contractor is primarily responsible for all fiber-optic and data communication testing and commissioning work. All testing and commissioning work shall be documented in detail as specified in the “Automation and Control Standards, Volume 6, Cabling” (Rev.17) and the results shall be verified and approved by the Employer’s Agent. The Contractor must invite the Employer’s Agent to witness the fibre optic testing at least 5 working days before fibre optic testing is carried out. All networking and data communication installations must also comply with all the requirements in the “Automation and Control Standards, Volume 6, Cabling” (Rev.17) and the “Automation and Control Standards, Volume 25, Labelling” (Rev.3) and the “Automation and Control Standards, Volume 7, Networking” (Rev.15).

### 3.2 Training

The tenderer must allow an amount to cover the cost for training of up to two Johannesburg Water personnel by the supplier (not only the Contractor) on new instrumentation supplied on this contract. Training will be by the supplier at the supplier’s premises or on site. If no training is required, then this amount will not be claimed

### 3.3 Maintenance Spares

The tenderer must provide PLC hardware spares as indicated in the list below. The tenderer must allow a corresponding cost for these spares in the BOQ.

#### Spares

	<i>Reference</i>	<i>Description</i>	<i>Qty</i>
<b>Modicon M580 Processors</b>	BMEP582040	CPU580-20 With Integrated Ethernet 10/100 Base-T RJ-45 port	1
<b>M580 Power Supplies</b>	BMXCPS3500	HIGH POWER AC POWER SUPPLY	1
<b>M580 Backplane</b>	BMEXBP0800	8 SLOTS BACKPLANE	1
	BMEXBP1200	12 SLOTS BACKPLANE	1
	BMXCRA31210	X80 RIO Drop E/IP Perf	1
<b>M580 Networks</b>	BMXNRP0201	Fiber Converter SM/LC 2CH 100Mb	1
	BMENOC0301	M580 Ethernet Comm. Module	1
<b>M580 Digital Inputs</b>	BMXDDI6402K	DIG 64I 24 VDC SINK	1

Employer:		Contractor:	
Witness:		Witness:	



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<b>M580 Digital Outputs</b>	BMXDDO3202K	DIG 32Q TRANS SOURCE 0.1A	1
<b>M580 Analogue Modules</b>	BMXAMI0810	ANA 8 U/I IN ISOLATED FAST	1
	BMXAMO0410	ANA 4 U/I OUT ISOLATED	1
	ABE7S16E2M0	BAS REL ST W10 16I 230VAC ISOLATED	1
	ABE-7R16S210	Sub-base with 16 N/O Relay Contacts 5A	1

### 3.4 Applicable SANS Standards

The Standard Specifications for all associated electrical and instrumentation work applicable to this Contract shall be SANS 10142-1:2003:

- I. This Specification is not issued with this volume but is available at the Contractor's expense from: Standards South Africa,
- II. **Office Address:**  
1 Dr Lategan Road, Groenkloof, PRETORIA
- III. **Postal Address:**  
Private Bag X191, PRETORIA, 0001
- IV. **Telephone:** National: (012) 428-6883  
International: + 27 12 428 6883
- V. **Telefax:**  
National: (012) 428-6928  
International: + 27 12 428 6928
- VI. **Email:** [sales@sabs.co.za](mailto:sales@sabs.co.za)

### 3.5 Particular Generic Specifications

The following Particular Generic Specifications forming part of the Contract have been written to cover phases or items of work involving a specialist type of operation or material to be encountered on this Contract and that are not adequately covered by the general specifications. Where there is conflict between the Particular Generic Specifications (listed below) and the general specifications (i.e. this tender document), the general specifications will take precedence.

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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Automation and Control Design Standards	
Volume 3	PLC Panels
Volume 5	Clean Power and Surge Protection
Volume 6	Cabling
Volume 7	Networking
Volume 8	Flow Measurement
Volume 9	Level Measurement
Volume 10	pH Measurement
Volume 19	Field Junction Boxes and Panels
Volume 21	Load Cells
Volume 23	Pressure Measurement
Volume 25	Labelling

The listed specifications above are included in Volume 2 of this tender document.

### 3.6 Plant and Materials

All materials intended for the purpose of this Contract shall bare the approval of the relevant SANS specifications. Any deviations there from shall be recorded and reported by the Contractor.

### 3.7 Data Sheets

All the data sheets required for equipment (such as flow meters, level meters, surge protection devices, power supplies, etc.) as required in the Automation And Control Design Standards are attached to this tender document. They must be completed and submitted with the tender. **Incomplete or missing data sheets will result in the disqualification of a tenderer.**

Employer:		Contractor:	
Witness:		Witness:	



## 4 QUALITY ASSURANCE

### 4.1. QA Plans

The contractor must submit a quality assurance plan for approval by the Employer's Agent.

### 4.2. Factory Acceptance Tests

Part of the QA plan must include factory acceptance tests of the PLC panels and Field Junction Boxes at the manufacturer's premises. These panels and IJBs/ICPs must undergo a similar test after delivery on site. The test procedures to be followed during these tests must be submitted for the approval of the Employer's Agent. The Employer's Agent must be notified no less than 5 working days in advance of such planned inspections.

## 5 C&I PROGRAM

When compiling his program, the Contractor has to take the following C&I activities and associated durations into account:

Employer:		Contractor:	
Witness:		Witness:	



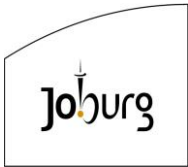
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### BUSHKOPPIE INFRASTRUCTURE RENEWAL PROJECT - C&I Program

Task Name	Duration
Obtain data sheets for all instruments, surge protection, power supplies, UPSs, etc. (Hold Point).	3 days
Approve C&I equipment.	15 days
Obtain detailed connection diagrams from contractor for all instruments and do detailed C&I designs. (Hold Point).	30 days
Obtain PLC panel GAs for approval. (Hold Point).	10 days
Discuss, alter if required and approve PLC Panel GAs.	10 days
Obtain Field JB GAs for approval. (Hold Point).	10 days
Discuss, alter if required and approve Field JB GAs.	10 days
Obtain control philosophy	2 days
WSP develop functional specifications.	30 days
Submit functional specifications to contractor and client for comment/approval.	15 days
WSP update functional specifications with contractor & client comments.	10 days
WSP develop PLC & SCADA software.	25 days
WSP do presentation of PLC & SCADA control to Client	10 days
WSP update PLC & SCADA software after presentation.	10 days
Check metalwork of PLC panels before painting. (Hold Point).	2 days
Check painting of PLC panels and equipment layouts before mounting of equipment. (Hold Point).	2 days
Do PLC panel FATs. (Hold Point).	10 days
Check metalwork of Field JBs before painting. (Hold Point).	2 days
Check painting of Field JBs and equipment layouts before mounting of equipment. (Hold Point).	2 days
Do Field JB FATs. (Hold Point).	5 days
Commissioning	Duration
Do PLC I/O loop checks (to verify after contractor has completed his checks).	15 days
Fiber Optic Testing	3 days
Do cold commissioning (if applicable).	5 days
Do hot commissioning.	20 days
Do handover checks and produce snag lists. (Practical handover).	8 days
Contractor to rectify snags.	15 days
Contractor to submit red-lined drawings.	15 days

Employer:		Contractor:	
Witness:		Witness:	



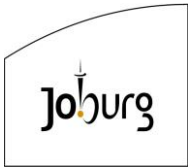
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Produce "As-Built" documentation.	15 days
Complete all relevant project close-out documentation.	10 days

Employer:		Contractor:	
Witness:		Witness:	



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## 6 UPS DATA SHEETS

The tenderer must complete the data sheet below with his tender:

Employer:		Contractor:	
Witness:		Witness:	



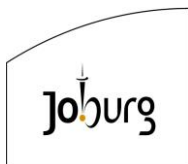
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Technical Data Sheet: UPS

DESCRIPTION	DATA
Make/Manufacturer	
Type/Model (E.g. true on-line, double conversion)	
Transformer-based unit (Y/N?)	
Technology employed (E.g. pulse width modulation)	
Output voltage variation	
Output frequency variation	
UPS rating (VA and Watts)	
UPS efficiency from zero to full load	
Maximum harmonic distortion at full load	
Overload handling capabilities (E.g. "x"% load for "y" minutes)	
Power backup period from batteries at full rated load	
Compliance with standards rating and markings (E.g. "Yes, full compliance" or "No".	
Tenderer to provide complete factory load test that can be witnessed by the Engineer?	
Staff available for installation, testing and backup service?	
Number of batteries to be used	
Type of batteries to be used	
Ah rating of batteries	

Employer:		Contractor:	
Witness:		Witness:	



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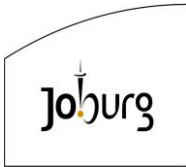
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Design life of batteries	
Local agent (Y/N)?	
Local agent contact details	
Guarantee period	

**DATA SHEET – OPEN CHANNEL FLOW METER**

<b>DESCRIPTION</b>	<b>DATA</b>
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type & Programmable (Y/N)?	
Digital Output Type & Rating (E.g. SPDT, 230V AC, 5A) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Accuracy	
Resolution	
Programmable Totaliser (Y/N)?	
Display Data & Type (E.g. instantaneous & total LCD)	
Transducer/Sensor range	
Transducer/Sensor temperature operating range	

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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Transducer/Sensor temperature compensation (Y/N)?	
Transducer/Sensor enclosure rating	
Local agent (Y/N)?	
Local agent contact details	
Guarantee period	

Employer:		Contractor:	
Witness:		Witness:	



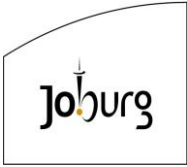
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**DATA SHEET – FULL PIPELINE FLOW METER (MAGNETIC)**

<b>DESCRIPTION</b>	<b>DATA</b>
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type & Programmable (Y/N)?	
Digital Output Type & Rating (E.g. SPDT, 230V AC, 5A or 24V DC output) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Accuracy	
Repeatability	
Programmable Totaliser (Y/N)?	
Display Data & Type (E.g. instantaneous & total LCD)	
Transducer/Sensor range	
Transducer/Sensor wafer-type or flange-type?	
Transducer/Sensor temperature operating range	
Transducer/Sensor temperature compensation (Y/N)?	
Transducer/Sensor enclosure rating	
Transducer/Sensor lining material	
Transducer/Sensor tube material	
Transducer/Sensor grounding details	
Transducer/Sensor equipped with “Empty Pipe” detection as specified (Y/N)?	
Local agent (Y/N)?	
Local agent contact details	

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	



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Guarantee period	
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Employer:		Contractor:	
Witness:		Witness:	



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DATA SHEET – FULL PIPELINE FLOW METER FOR DISTRIBUTION/DIVERSION

DESCRIPTION	DATA
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type & Programmable (Y/N)?	
Digital Output Type & Rating (E.g. SPDT, 230V AC, 5A) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Accuracy	
Repeatability	
Programmable Totaliser (Y/N)?	
Display Data & Type (E.g. instantaneous & total LCD)	
Transducer/Sensor range	
Transducer/Sensor temperature operating range	
Transducer/Sensor material	
Transducer/Sensor rating	
Local agent (Y/N)?	
Local agent contact details	
Guarantee period	

Employer:		Contractor:	
Witness:		Witness:	



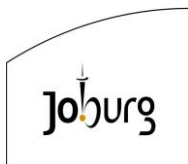
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DATA SHEET – LEVEL METER

DESCRIPTION	DATA
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type & Programmable (Y/N)?	
Digital Output Quantity, Type & Rating (E.g. 5 x SPDT, 230V AC, 5A) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Accuracy	
Resolution	
Display Data & Type (E.g. instantaneous level & relay status LCD)	
Transducer/Sensor range	
Transducer/Sensor temperature operating range	
Transducer/Sensor temperature compensation (Y/N)?	
Transducer/Sensor enclosure rating	
Local agent (Y/N)?	
Local agent contact details.	
Guarantee period	

Employer:		Contractor:	
Witness:		Witness:	



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DATA SHEET – pH METER

DESCRIPTION	DATA
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type & Programmable (Y/N)?	
Digital Output Quantity, Type & Rating (E.g. 3 x SPDT, 230V AC, 5A) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Accuracy	
Resolution	
Display Data & Type (E.g. instantaneous pH & relay status LCD)	
Transducer/Sensor pH range	
Transducer/Sensor temperature measuring range	
Transducer/Sensor temperature operating range	
Transducer/Sensor temperature compensation (Y/N)?	
Transducer/Sensor enclosure rating	
Transducer/Sensor cleaning system type & programmable (Y/N)?	
Local agent (Y/N)?	
Local agent contact details.	
Guarantee period	

Employer:		Contractor:	
Witness:		Witness:	



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**DATA SHEET – PRESSURE METER**

<b>DESCRIPTION</b>	<b>DATA</b>
Make/Manufacturer	
Type/Model	
Power Supply (Voltage)	
Analogue Output Type	
Digital Output Quantity, Type & Rating (E.g. 2 x PNP, 250mA) & Programmable (Y/N)?	
Controller/Transmitter Enclosure Rating	
Controller/Transmitter Accuracy	
Resolution	
Display Data & Type (E.g. instantaneous pressure & LCD)	
Transmitter ambient temperature range	
Sensor temperature operating range	
Sensor process connection - Flush diaphragm (Y/N)?	
Transducer/Sensor temperature compensation (Y/N)?	
Sensor overpressure safety rating (??? times range)	
Local agent (Y/N)?	
Local agent contact details.	
Guarantee period	

<b>Employer:</b>		<b>Contractor:</b>	
<b>Witness:</b>		<b>Witness:</b>	