O. R. TAMBO DISTRICT MUNICIPALITY

O.R. TAMBO
DISTRICT MUNICIPALITY

PROJECT NUMBER: MIS 535 944 B

DESCRIPTION: NGANGELIZWE AND WATERFALL SEWER INFRASTRUCTURE UPGRADE:

NGANGELIZWE SEWER RETICULATION UPGRADE PROJECT

CONTRACT 2

VOLUME 2

MAY 2025

NAME OF BIDDER:	
BID AMOUNT:	**SEE VOLUME 1**
CSD SUPPLIER NUMBER:	
CLOSING DATE & TIME:	**27TH JUNE 2025 @12H00**

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PART C3: SCOPE OF WORK

O. R. TAMBO DISTRICT MUNICIPALITY

CONTRACT NO: MIS 535 924 B
NGANGELIZWE SEWER RETICULATION UPGRADE PROJECT

C3.1. DESCRIPTION OF THE WORKS

STATUS

In the event of any discrepancy between the Scope of Work and any part of the SANS 1200 Standardized Specifications, the Bill of Quantities or the Drawings, the Scope of Work shall take precedence and prevail in the Contract.

C3.1.1 Employer's Objectives

The objective of the Employer (O. R. TAMBO DISTRICT MUNICIPALITY) is to provide a long-term reliable and adequate sewer system to serve the township of Ngangelizwe to alleviate the current sewer reticulation challenges facing the township.

Based on the specific goals, the Employer is aiming to promote enterprises located in Eastern Cape Province and in O. R. Tambo District in particular.

C3.1.2 Overview of the Works

This contract entails the upgrade of the existing sewer reticulation system in Ngangelizwe Township which is in KSD Ward 1 and 2.

C3.1.3 Extent of the Works

The Scope of Work envisaged to be carried out under this Contract is summarized as follows:

The following is the scope of replacement:

Civil Works

- 25,250km of gravity sewer network in Ngangelizwe
- Approx 1400 new manholes in Ngangelizwe sewer network
- Installation of 1 Sewer Meter at the Pump Station.
- Erf / House connection to the sewer reticulation.
- Upgrade of Ngangelizwe Pump Station:

- Installation of Silt Traps
- Installation of 2 Waste Skips
- Installation of an Access Road from Mpondomise Road to the Ngangelizwe Pump Station
- Rewire Electrical Connections at the MCC

Mechanical Works

- Installation of 15mm coarse screens (Ngangelizwe Pump Station)
- Installation of 1 Sewer Meter at the 3 Pump Station.

Electrical Works

- Rewire electrical connections at the Ngangelizwe PS

General

- Subcontracting a minimum of 30% of the of value of work excluding manufacture of pipes, contingencies, and provisional sums to SMMEs as per the project specification.
- Dealing with community participation with regards to the construction.
- Environmental management of the area during and after the completion of construction.
- Compliance with the requirements of the Occupational Health & Safety Act of 1993, Construction Regulations 2014 and COVID-19 requirements.

This description of the Works is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract. Approximate quantities of each type of work are given in the Bill of Quantities.

C3.1.4 Location of the Works

The Project is located in Ngangelizwe Township which are situated approximately 3 km South-East of Mthatha CBD, under the King Sabata Dalindyebo Local Municipality (KSDLM) within the jurisdiction of the OR Tambo District Municipality in the Province of the Eastern Cape. The project area can be accessed from N2 which is Nelson Mandela Road by a district collector road called Tutor Ndamase Road then turn left on Khwezi Engen garage to Tembu Street. The coordinates of the center of the site are as shown in **Table 1-1** below.

TABLE 1-1:PROECT LOCALITY COORDINATES

Name	Latitude (S)	Longitude (E)
Ngangelizwe Township	31^{0}36’23.63” S	28^{0}48’29.58” E

C3.1.5 Temporary Works

The Contractor will be responsible for determining the extent of temporary works required to execute the contract, and the cost thereof shall be included in the rates for the respective items of work. Nonetheless, it is envisaged that temporary work may be required for the following activities:

- Pipeline trenches requiring shoring due to space and depth constraints.
- Construction of pipelines near existing fences, which must be temporarily removed, will require the erection and maintenance of temporary fencing until restoration of the original fences.
- Construction of pipe trenches near existing properties or through existing accesses may require the provision of temporary access for pedestrians, livestock or vehicles.
- Traffic control measures where construction takes place at or close to existing roads.
- Safety measures deemed necessary by the Health and Safety specification or the Contractor's own risk assessment (e.g. pedestrian barriers).

C3.1.6 Construction Programme

The programme of construction shall be submitted to the Employer's Agent within the time stipulated in these documents. The programme shall clearly show all activities related to the works and shall indicate which activities are on the critical path.

In compiling the programme, the Contractor shall consider the following:

- The requirements and effects of employing labour-intensive construction methods.
- The lead-time for training of local labour.
- The accommodation and safeguarding of public access and traffic.
- Establishment and de-establishment times.
- Time to obtain all permits and wayleaves.
- Appointment of Community Liaison Officer (CLO).
- All public and Contractor close down periods.
- All other activities required in terms of this document.

If during the contract, the execution of the work deviates in any manner from the programme, the Contractor shall, on instruction by the Employer's Agent, within one week of such instruction submit a revised programme. Should such a revision be because of the Contractor falling behind with his work, the programme shall clearly show the steps to be taken to rectify the situation so as to enable the contract to be completed within the stipulated contract period. Positive steps to increase production through increased resources, or the more efficient usage of existing resources shall accompany such a programme. The tender programme shall however be used.

C3.2. ENGINEERING

C3.2.1 Design Services and Activity Matrix

Responsibilities for design and related documentation are as follows:

• Concept, feasibility and overall process	Employer
• Basic engineering and detail layouts to tender stage	Employer
• Final design to approved construction stage	Employer
• Temporary works	Contractor
• Preparation of record drawings and GIS information	Contractor/Employer

C3.2.2 Employer's Design

The Employer's design encompasses the permanent Works described in C.3.1.3 and what is included on the drawings.

C3.2.3 Design Brief

The design of the permanent Works is the responsibility of the Employer's Agent.

The Contractor is responsible for the design of the temporary Works required for the construction and execution of the permanent Works.

Where the Contractor is to supply the design of designated parts of the permanent Works or temporary Works, he shall supply full working drawings supported by a professional Employer's Agent's design certificate.

C3.2.4 Drawings

The Contractor shall use only the dimensions stated in figures on the Drawings in setting out the Works and dimensions shall not be scaled from the Drawings, unless required by the Employer's Agent.

The Employer's Agent will, on the request of the Contractor, and in accordance with the provisions of the Conditions of Contract, provide such dimensions as may have been omitted from the Drawings.

The Contractor shall ensure that accurate As-Built records are kept of all infrastructure installed or relocated during the contract. The position of pipe bends, junction boxes, duct ends, and all other underground infrastructure shall be given by either co-ordinates, or stake value and offset. Where necessary, levels shall also be provided.

A marked-up set of Drawings shall be kept and updated by the Contractor on a day-to-day basis. This information shall be supplied to the Employer's Agent Representative on a regular basis.

All information in possession of the Contractor where required by the Employer's Agent and/or

the Employer's Agent Representative to complete the As Built/Record Drawings, must be submitted to the Employer's Agent Representative before the Certificate of Completion may be issued.

The Drawings prepared by the Employer for the permanent Works are listed and bound under **Appendix J.**

The Employer reserves the right to issue amended and/or additional Drawings during the Contract.

C3.2.5 Design Procedures

The Contractor is responsible for the design of all the temporary works required for the construction and

execution of the Permanent Works. This includes, inter alia, temporary roads, access control, accommodation of traffic, shoring of trenches and excavations, dewatering, all health and safety measures, environmental management as well as temporary support systems, until the completion of the Contract.

C3.3. PROCUREMENT

C3.3.1 Preferential Procurement Procedures

All works to be completed in this contract shall be executed in accordance to the O. R. Tambo District Municipality's preferential procurement policies and procedures.

C3.3.2 Subcontracting

C3.3.3 Scope of Mandatory Subcontract Works

Where possible, work that can be subcontracted to EMEs and QSEs is identified and detailed in Part C1, Section C1.4 and in Part C1, Section C1.3, the requirements for the procurement and employment of local labour are specified. It is noted that the work identified in this document is not exhaustive and it shall be required from the Contractor to ensure that a minimum of 30% of the Works is done by local EMEs and QSEs.

No work may be sub-contracted to another party unless approval is given by the ORTDM in writing. The Contractor is to submit to the ORTDM in writing a request for appointment of a particular sub-contractor. Accompanying this request is to be the full detail of the sub-contractor, including:

- Previous experience.
- Work which will be sub-contracted to him/her.
- Approximate value of the work to be sub-contracted.

C3.3.4 Preferred Subcontractors / Suppliers

The Contractor will be required to liaise with the Employer, Employer's Agent and local community structures to finalise the list of local EMEs and QSEs to be employed as part of the project.

C3.3.4.1 Subcontracting Procedures

A formal tender process will be followed to appoint the Subcontractor which will be facilitated by the Employer, Employer's Agent and Main Contractor.

All subcontractors appointed under **C3.3.2.1** above shall be:

- Registered with the CIDB
- Allocated work within the category and value limits designated by their CIDB grading
- Be in good standing with the Department of Labour
- Registered on the Central Supplier Database.

Proof of the above is to be provided to the Employer's Agent before appointment of the subcontractor.

C3.3.5 Attendance on subcontractors

The Contractor shall guide, assist, advise and mentor the local EME and QSE subcontractor/s and guidance on how to establish and determine rates.

The Contractor shall be responsible for ensuring that the prospective local EME and QSE subcontractor/s fully comprehends the:

- Implications of the liabilities and responsibilities inherent in the contract into which the tenderer entered.
- Implications of the tendered rates.
- Scope and extent of the Works.
- Proper procedures for the submission of a tender.
- Procedures and basis on which tenders will be evaluated and awarded.

The Contractor shall closely manage, mentor, supervise, guide and assist the EEs in all aspects of management, planning, execution and the completion of work.

The above shall include inter alia, but is not limited to, the following:

(i) Planning and programming of the Works.
(ii) The sourcing, ordering, purchasing, hiring all the necessary Construction Equipment, Materials, tools and incidentals necessary and required for the successful execution and completion of the Permanent as well as the Temporary Works.
(iii) Labour relations and employment.
(iv) Monthly measurements, costing and invoicing.
(v) General safety, occupational health and safety matters.
(vi) Functions of civil engineering infrastructure, structures, services and systems.
(vii) Interpreting and understanding the contract.
(viii) Construction and maintenance methods and procedures.
(ix) Communication.
(x) Cash-flow control, submitting invoices and payment certificates.
(xi) Planning, programming, scheduling, critical path control and acceleration.
(xii) Maintenance planning.
(xiii) Material procurement and control.
(xiv) Risk limitation and management.
(xv) Quality assurance and procedures.
(xvi) Compliances with all applicable laws, regulations, statutory provisions and agreements.
(xvii) General Conditions of Contract and Contract Data.
(xviii) Contractual claims, if situations arise that entitle a contractor to claims in terms of the Conditions of Contract.
(xix) Profit and loss.
(xx) Replacement and running costs of Construction Equipment.

The extent and level of management, mentorship, supervision, guidance and assistance to be

provided by the Contractor shall be in commensuration with the expertise of the relevant EME and QSE and should be so directed as to enable the EME and QSE to achieve the successful execution and completion of the respective works.

C3.4. CONSTRUCTION

C3.4.1 WORKS SPECIFICATIONS

C3.4.1.1 Applicable SANS 1200 Standardised Specifications

The SANS 1200 Standardised Specifications for civil engineering construction that are applicable are listed in C3.7.1.

C3.4.1.2 Particular Specifications

The Particular Specifications for work not covered by the SANS 1200 Standardised Specifications are listed in C3.7.1 and included in C3.7.3.

C3.4.1.4 Variations and Additions to the SANS 1200 Standardised Specifications

Variations and additions to the SANS 1200 Standardised Specifications listed in C3.7.1 are given in section C3.7.2.

C3.4.2 SITE ESTABLISHMENT

C3.4.2.1 Services and facilities provided by the Employer

(a) Water Sources

The Contractor shall make his own arrangements regarding the supply of water.

The Contractor shall, in accordance with the provisions of subclause C3.4.2.2(b), and at his own expense, make all arrangements necessary for the supply and distribution of water as may be required for the purposes of executing the Contract, including water for both construction purposes and domestic use as well as for making all arrangements in connection therewith.

The Contractor shall further, at his own expense, be responsible for providing all necessaries for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping, valves, tanks, pumps, meters and other plant and equipment, as well as for all work and superintendence associated therewith. Payment for the aforementioned shall be deemed to be covered by the rates and prices tendered and paid for the various items of work included under the Contract.

The Contractor shall make himself thoroughly acquainted with the regulations relating to the use of water and shall take adequate measures to prevent the wastage of water.

The sources of all water utilised for the purposes of the Contract shall be subject to the prior approval of the Employer's Agent, which approval shall not be unreasonably withheld. The Contractor shall comply with all prevailing legislation in respect of drawing water from natural and other sources and shall, when required by the Employer's Agent, produce proof of such compliance.

The distribution of water shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations. All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall comply with any further relevant specifications of the Contract.

The Contractor shall, whenever reasonably required by the Employer's Agent, produce test results demonstrating such compliance. Water provided by the Contractor for human consumption shall be healthy and potable to the satisfaction of the health authorities in the area of the Site.

The Employer accepts no responsibility for the shortage of water due to any cause whatsoever or for the additional costs incurred by the Contractor as a result of such shortage.

(b) Power / Electricity Supply

The Contractor shall make his own arrangements with the Electricity Department for a supply of electricity if required and shall pay establishment and consumption costs at the tariffs ruling at the time.

The Contractor shall, in accordance with the provisions of subclause C3.4.2.2(c), and at his own cost, make all arrangements necessary for the supply and distribution of electrical power required for construction purposes as well as for use in and about his site establishment.

The Contractor shall comply with all prevailing legislation in respect of the generation and distribution of electricity and shall, when required by the Employer's Agent, produce proof of such compliance.

No separate payment will be made to the Contractor for the obtainment, distribution and consumption of electricity, the costs of which will be deemed to be in the Contractor's tendered rates and prices.

(c) Excrement Disposal / Sanitary Facilities

The Contractor shall, in complying with his obligations in terms of subclause C3.4.2.2(d), at his own cost, be responsible for safely and hygienically dealing with and disposing of all human excrement and similar matter generated on the site during the course of the Contract, all to the satisfaction of the responsible health authorities in the area of the site.

All such excrement shall be removed from the Site and shall not be disposed of by the Contractor on the Site. The Contractor shall further comply with any other requirements in this regard as may be stated in the Contract.

The Contractor shall further, as a minimum, supply and maintain chemical toilets for use by his workmen. The number of toilets shall be based on one toilet per fifteen personnel on site.

Under no circumstances will the Contractor's staff be allowed to use any other toilet facilities in

and around the Site.

(d) Disposal Site

All material cleared on the site, rubble, spoil and refuse shall be disposed of at the one of the municipal solid waste sites. Hazardous material shall only be disposed of at the waste site with Waste license issued by the Department of Environmental Affairs.

These are dedicated disposal sites and therefore no separate overhaul shall be paid. The Contractor shall pay all charges levied at the waste site and must make allowance in his rates to cover these charges as no separate payment will be made in this regard.

(e) Area for Contractor's site establishment

The Employer has no suitable areas available where the Contractor may erect offices, workshops, stores and other facilities that he requires for the purposes of the Contract. The Contractor shall, at his own cost, be responsible for locating and making all arrangements necessary for securing an area suitable to meet his needs in respect of the erection of the Contractor's offices, stores and other facilities, including the facilities

to be provided for the Employer's Agent in accordance with the Contract.

Any potential area proposed by the Contractor shall be within reasonable proximity to the Site of the Works and its location shall be subject to the approval of the Employer's Agent, which approval shall not be unreasonably withheld.

The Contractor shall be responsible for arranging, at his own cost, for the provision of all services he may require in the area, as well as elsewhere on the Site.

(f) Accommodation of employees

The Contractor shall make his own arrangements for the accommodation of his employees. Where field accommodation is required, the Contractor shall comply fully with the wishes of the various landowners, as in their agreement with the Employer, to the satisfaction of both landowner and Employer.

C3.4.2.2 Facilities provided by the Contractor

The Contractor shall provide for the use of the Employer's Agent, maintain and service, as applicable, the following facilities as specified in SANS 1200 AB and PSAB.

(a) Facilities for the Employer's Agent

The Contractor shall provide on the Site, for the duration of the Contract and for the exclusive use of the Employer's Agent and/or his Employer's Agent's Representative (as applicable), the various facilities described hereunder. All such facilities shall be provided promptly on the commencement of the Contract and failure on the part of the Contractor to provide any facility required in terms of this specification shall constitute grounds for the Employer's Agent to withhold payment of the Contractor's tendered Preliminary and General items until the facility has been

provided or restored as the case may be.

(i) Contract Nameboard

The Contractor shall provide, erect and maintain 2 No. of Contract Nameboards at such positions and locations as directed by the Employer's Agent. The Contractor shall, before ordering or manufacturing any such Contract nameboards, obtain the Employer's Agent written approval in respect of all names and wording to appear on the Contract nameboards. The Contractor shall keep the Contract nameboard in good state of repair for the duration of the Contract and shall remove them on completion of the Contract.

(ii) Health and Safety Sign Board

The Contractor shall erect and maintain 1No. of Health and Safety Sign Board at such positions and locations as directed by the Health and Safety Agent and the requirements specified on the Health and Safety Plan.

(iii) Office building

The Contractor shall provide on the Site an office for the exclusive use of the Employer's Agent and his Representative. Such office shall comply with and be furnished in accordance with the requirements of subclause 3.2 of SANS 1200 AB and PSAB. The Contractor shall maintain the office in accordance with the requirements of subclause 5.2 of SANS 1200 AB.

Such office accommodation shall be provided within the Contractor's site establishment facilities.

(iv) Site Meeting venue

The Contractor shall provide within his own site establishment facilities, a suitably furnished office or other venue capable of comfortably accommodating a minimum of **fifteen** (15) persons at site meetings. The Employer's Agent shall be allowed free use of such a venue for conducting any other meetings concerning the Contract at all reasonable times.

(v) Survey equipment and assistant(s)

The Contractor shall, for the duration of the Contract, in accordance with the requirements of PSAB provide survey equipment for the exclusive use of the Employer's Agent and his staff.

The Contractor shall, in accordance with the requirements of subclause 5.5 of SANS 1200 AB, make available to the Employer's Agent, two (2) survey assistants.

(vi) Site Instruction Book

The Contractor shall always keep a triplicate book for site instructions on the Site.

(b) Water

The Contractor shall, at his own expense, be responsible for obtaining and distributing all water as may be required for the purposes of executing the Contract, including water for both construction purposes and domestic use, as well as for making all arrangements in connection therewith.

The Contractor shall further, at his own expense, be responsible for providing all necessaries for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping, valves, tanks, pumps, meters and other plant and equipment, as well as for all work and superintendence associated therewith.

The sources of all water utilised for the purposes of the Contract shall be subject to the prior approval of the Employer's Agent, which approval shall not be unreasonably withheld.

The Contractor shall comply with all prevailing legislation in respect of drawing water from natural and other sources and shall, when required by the Employer's Agent, produce proof of such compliance. The distribution of water shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations.

All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall comply with any further relevant specifications of the Contract. The Contractor shall, whenever reasonably required by the Employer's Agent, produce test results demonstrating such compliance. Water provided by the Contractor for human consumption shall be healthy and potable to the satisfaction of the health authorities in the area of the Site.

No separate payment will be made to the Contractor for the obtainment, distribution and consumption of water, the costs of which will be deemed to be included in the Contractor's tendered rates.

(c) Electricity

The Contractor shall, at his own expense, be responsible for obtaining and distributing all electricity as he may require for the purposes of executing the Contract, including electricity for both construction purposes and domestic use, as well as for making all arrangements in connection therewith.

The distribution of electricity shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations.

No separate payment will be made to the Contractor for the procurement, distribution and consumption of electricity, the costs of which will be deemed to be in the Contractor's tendered rates and prices.

(d) Excrement disposal

The Contractor shall, at his own expense, be responsible for safely and hygienically dealing with and disposing of all human excrement and similar matter generated on the Site during the course of the Contract, to the satisfaction of the responsible health authorities in the area of the Site and the Employer's Agent. All such excrement shall be removed from the Site and shall not be disposed of by the Contractor on the Site.

The Contractor shall further comply with any other requirements in this regard as may be stated in the Contract.

No latrines are available and therefore the Contractor shall supply portable chemical toilets for use by his workmen. The number of toilets shall be based on one toilet per fifteen personnel on site. Under no circumstances will the Contractor's staff be allowed to use private or public toilet facilities.

The Contractor shall provide water and soap for his staff to be able to wash with at each site of the Works. The wastewater shall be disposed of off-site.

No separate payment will be made to the Contractor in respect of discharging his obligations in terms of this subclause and the costs thereof shall be deemed to be included within the Contractor's tendered Preliminary and General Items.

C3.4.2.3 Site Usage and Security on site

Access to site shall be limited to the Contractor and his personnel. The Contractor shall be responsible to control unauthorised entry to the site and shall inform the Employer's Agent of any breach of such rules. The site shall be managed and used for its intended purpose. The Contractor is required to keep a visitors log and ensure full compliance with site safety standards.

The Contractor shall make provision for security on site against theft and robbery, as his sole responsibility. The cost for providing adequate security, as and when required, must be borne by the Contractor.

C3.4.2.4 Permits and Wayleaves

The Contractor shall be responsible for obtaining all of the necessary wayleaves, permissions or permits applicable to working near any existing services or other infrastructure on Site, and shall ensure that any wayleaves, permissions or permits obtained by the Employer's Agent prior to the award of the contract are transferred into the Contractor's name.

The Contractor shall abide by any conditions imposed by such wayleaves, permissions or permits. The Contractor shall ensure that all wayleaves, permissions and permits are kept on site and are available for inspection by the relevant service authorities on demand.

The Contractor shall also ensure that any wayleaves in respect of electricity services are renewed timeously every three months.

C3.4.2.5 Features requiring special attention

(a) Site maintenance

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

The general neatness and tidiness along the pipe route is to be maintained and therefore the Contractor shall on a day-to-day basis, keep the area of the Works in a condition acceptable to the Employer's Agent, the Employer's Health and Safety Agent and the Environmental Control Officer.

(b) Testing and Quality Control

(i) Contractor to engage services of an independent laboratory

Notwithstanding the requirements of the Specifications pertaining to testing and quality control, the Contractor shall engage the services of an approved independent laboratory to undertake all testing of materials, the results of which are specified in, or may reasonably be inferred from, the Contract. These results will be taken into consideration by the Employer's Agent in deciding whether the quality of materials utilised, and workmanship achieved by the Contractor comply with the requirements of the Specifications. The foregoing shall apply irrespective of whether the specifications indicate that the said testing is to be carried out by the Employer's Agent or by the Contractor.

The Contractor shall be responsible for arranging with the independent testing laboratory for the timeous carrying out of all such testing specified in the Contract, at not less than the frequencies and in the manner specified. The Contractor shall promptly provide the Employer's Agent with copies of the results of all such testing carried out by the independent laboratory.

For the purposes of this clause, an "independent laboratory" shall mean an "approved laboratory" (as defined in subclause PSA 7.2) which is not under the management or control of the Contractor and in which the Contractor has no financial interest, nor which has any control or financial interest in the Contractor.

(ii) Additional testing required by the Employer's Agent

In addition to the provisions of subclause C3.4.2.5(b)(i): Contractor to engage services of an independent laboratory, the Employer's Agent shall be entitled at times during the Contract to require that the Contractor arrange with the independent laboratory to carry out any such tests, additional to those described in subclause C3.4.2.5(b)(i), at such times and at such locations in the Works as the Employer's Agent shall prescribe. The Contractor shall promptly and without delay arrange with the independent laboratory for carrying out all such additional testing as required by the Employer's Agent, and copies of the test results shall be promptly submitted to the Employer's Agent.

(iii) Cost of Testing

a) Testing in term of subclause C3.4.2.5(b)(i)

The costs of all testing carried out by the independent laboratory in accordance with the requirements of subclause C3.4.2.5(b)(i), above shall be borne by the Contractor and shall be deemed to be included in the tendered rates and prices for the respective items of work as listed in the Bill of Quantities and which require testing in terms of the Specifications. No separate payments will be made by the Employer to the Contractor in respect of any testing carried out in terms of subclause C3.4.2.5(b)(i).

Where, as a result of the consistency of the materials varying or as a result of failure to meet the required specifications for the work, it becomes necessary to carry out additional tests (e.g. re-tests on rectified work and/or replacement materials), the costs of such additional testing shall be for the Contractor's account.

b) Additional tests required by the Employer's Agent

The costs of any additional tests required by the Employer's Agent in terms of subclause C3.4.2.5(b)(ii): Additional testing required by the Employer's Agent, shall be reimbursed to the Contractor against substitution of the Provisional Sum allowed therefore in the Bill of Quantities; provided always that the costs of any such additional tests ordered by the Employer's Agent, the results of which indicate that the quality of the materials utilised and/or the standard of workmanship achieved are/is not in accordance with the specifications, shall not be reimbursable to the Contractor.

(c) Contractor supplied equipment

The Contractor shall when required to supply any testing, measuring and/or survey equipment for the Employer's Agent's use provide calibration certificates or verification certificates (as appropriate) for all equipment. This shall apply for both shared equipment as well as for equipment specified to be provided for the Employer's Agent's use on site.
Calibration or verification, by certified authorities shall be subject to the Employer's Agent's approval prior to the delivery of any equipment to the Employer's Agent; and thereafter at intervals as prescribed for the relevant equipment but not less than every twelve (12) months.

The calibration or verification certificate for each item of equipment shall be submitted to the Employer's Agent for approval prior to its use or within seven (7) days of subsequent re-calibration/verification.

Unless otherwise provided for in the bill of quantities the cost of providing the above specified equipment shall be deemed to be included in the tendered rates and prices for the respective items of work as listed in the Bill of Quantities.

Failure to submit certificates shall result in payment for the equipment being withheld.

(d) Opening up and closing don of designated borrow pits

Measurement and payment for opening up and closing down designated borrow pits, including removing and stockpiling overburden and restoring the Site, shall be made under item 8.3.4 of SANS 1200 D. This item applies to all borrow material required under this Contract.

The requirements of subclause 5.2.2.2 of SANS 1200 D regarding the opening up, maintenance and closing down of borrow pits shall be adhered to.

(e) Access to properties

The Contractor shall organise the work to cause the least possible inconvenience to the public and to the property owners adjacent to or affected by the work, and except as hereunder provided, shall at all times provide and allow pedestrian and vehicular access to properties within or adjoining or affected by the area in which he is working. In this respect the Contractor's attention is drawn to Clause 8.1.2 of the Conditions of Contract.

If, as a result of restricted road reserve widths and the nature of the work, the construction of bypasses is not feasible, construction shall be carried out under traffic conditions to provide access to erven and properties.

Notwithstanding the afore-going, the Contractor may, with the prior approval of the Employer's Agent (which approval shall not be unreasonably withheld), make arrangements with and obtain

the acceptance of the occupiers of erven and properties to close off part of a street, road, footpath or entrance temporarily, provided that the Contractor duly notifies the occupiers of the intended closure and its probable duration, and reopens the route as punctually as possible. Where possible, such streets, roads, footpaths and entrances shall be made safe and reopened to traffic overnight. Such closure shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs, drums and other safety measures appropriate to the circumstances shall be provided by the Contractor to suit the specific conditions.

(f) Monthly statements and payment certificates

The statement (measured quantities) to be submitted by the Contractor in terms of Clause 6.10 of the Conditions of Contract shall be prepared by the Contractor at his own cost, strictly in accordance with the standard payment certificate prescribed by the Employer's Agent, in digital electronic computer format. The Contractor shall, together with a copy of the digital electronic computer file of the statement, submit two (2) A4 size paper copies of the statement.

For the purposes of the Employer's Agent payment certificate, the Contractor shall subsequently be responsible, at his own cost, for making such adjustments to his statement as may be required by the

Employer's Agent for the purposes of accurately reflecting the actual quantities and amounts which the Employer's Agent deems to be due and payable to the Contractor in the payment certificate.

The Contractor shall, at his own cost, make the said adjustments to the statement and return it to the Employer's Agent within three (3) normal workings days from the date on which the Employer's Agent communicated to the Contractor the adjustments required. The Contractor shall submit to the Employer's Agent five (5) sets of A4 size paper copies of such adjusted statement, together with a copy of the electronic digital computer file thereof.

Any delay by the Contractor in making the said adjustments and submitting to the Employer's Agent the requisite copies of the adjusted statement for the purposes of the Employer's Agent payment certificate will be added to the times allowed to the Employer's Agent in terms of Clause 6.10.4 of the Conditions of Contract to submit the signed payment certificate to the Employer and the Contractor. Any such delay will also be added to the period in which the Employer is required to make payment to the Contractor.

The Contractor is further required to complete the monthly reporting template forms, refer to PSA 8.1.2.2 and Appendix B. These forms shall be submitted together with the Contractor's monthly payment certificates. Payment of the Contractor is conditional on this information being accurate and timeously provided. The Employer's Agent payment certificate template will be used as the only format for submission to the Employer.

The monthly statements accompanying the payment certificates shall include:

i. Contractor's Invoice;
ii. Interim Payment Certificate;
iii. Proof of Delivery and Invoices of all materials Claimed as Materials on Site;
iv. Construction Progress Report, including all items as per C1.4 Item 4.2 Monthly Returns
v. Programme update
vi. Cashflow vs Expenditure to date report, , including all items as per C1.4 Item 4.2 Monthly Returns

vii. Proof of Job Creation / Signed Labour Returns
viii. Detailed report on monthly and cumulative Contract Participation Goals achieved, as per Item C1.4 Item 4.2 Monthly Returns.

(g) Construction in restricted areas

Working space is sometimes restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. Notwithstanding, measurement and payment will be strictly according to the specified cross-sections and dimensions irrespective of the method used, and the rates and prices tendered will be deemed to include full compensation for any difficulties encountered by the Contractor while working in restricted areas. No extra payment nor any claim for payment due to these difficulties will be considered.

(h) Notices, signs, barricades and advertisements

All notices, signs and barricades, as well as advertisements, may be used only if approved by the Employer's Agent. The Contractor shall be responsible for their supply, erection, maintenance and ultimate removal and shall make provision for this in his tendered rates.

The Employer's Agent shall have the right to instruct the Contractor to move any sign, notice or advertisement to another position, or to remove it from the Site of the Works if in his opinion it is unsatisfactory, inconvenient or dangerous.

(i) Workmanship and quality control

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality control system and provide suitably qualified and experienced Employer's Agents, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control, including testing and mix designs carried out by the Contractor, will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardised Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Employer's Agent for examination and measurement, the Contractor shall furnish the Employer's Agent with the results of the relevant tests, mix designs, measurements and levels to demonstrate the achievement of compliance with the Specifications.

C3.4.2.6 Extension of time due to abnormal rainfall

a) Extension of time in respect of delays resulting from wet climatic conditions on the Site will only be considered in respect of abnormally wet climatic conditions and shall be

determined for each calendar month or part thereof, in accordance with the formula given below:

$$V = (Nw - Nn) + \frac{(Rw - Rn)}{X}$$

Where:

V = Extension of time in calendar days in respect of the calendar month under consideration:

If V is negative and its absolute value exceeds Nn, then V shall be taken as equal to minus Nn.
When the value of V for any month exceeds the number of days in the particular month, V will be the number of days in the month.

Nw = Actual number of days during the calendar month on which a rainfall of 10 mm or more has been recorded.

Nn = Average number of days in the relevant calendar month, as derived from existing rainfall records, on which a rainfall of 20mm or more has been recorded for the calendar month.

Rw = Actual average rainfall in mm recorded for the calendar month under consideration.

Rn = Average rainfall in mm for the calendar month as derived from existing rainfall records as stated in the Site Information.

The factor (Rw - Rn)/X shall be deemed to be a fair allowance for variations from the average number of days during which the rainfall did not exceed Y mm but wet conditions prevented or disrupted work.

b) The rainfall records for Mthatha for the period 2000 to 2020 from South African Weather Service (see Appendix G) are reproduced in the accompanying table, and the monthly averages (Rn and Nn) for

c) this period shall, for the purposes of this Contract be taken as normal and as the values to be substituted for Rn and Nn. The values of X and Y shall be 20 and 10 respectively.

d) The potential extension of time V has been calculated for each month and year of the period concerned to indicate the possible effect of the rainfall formula. The values of V were obtained by applying the rainfall formula and using the actual rainfall figures and the calculated values of Rn and Nn indicated in the table.

e) The Contractor shall, at his own cost, provide and erect on the Site at a location approved by the Employer's Agent, an approved rain gauge, which shall be fenced off in a manner which will prevent any undue interference by workmen and others. The Contractor shall, at his own cost, arrange for the reading of the rain gauge on a daily basis for the duration of the Contract. The gauge readings, as well as the date and time at which the reading was taken shall be recorded in a separate record book

f) provided by the Contractor for this purpose. All entries in the rainfall record books shall be

signed by the person taking the reading and the gauge shall be properly emptied immediately after each reading has been taken. If required by the Employer's Agent, the Employer's Agent shall be entitled to witness the reading of the gauge.

g) The Contractor's claims in terms of Clause 5.12 of the Conditions of Contract for extension of time in respect of delays resulting from wet climatic conditions on the Site during each month, shall be submitted in writing to the Employer's Agent monthly; provided always that

(i) the period allowed to the Contractor in terms of Clause 10 of the Conditions of Contract in which to submit his claim for each month shall be reduced to seven (7) days, calculated from the last day of the month to which the claim applies; and

(iii) the 28-day period allowed to the Employer's Agent in terms of Clause 10.1.2 of the Conditions of Contract in which to give his ruling on the claim, shall be reduced to fourteen (14) days.

The Contractor's monthly claim shall be accompanied by a copy of the signed daily rainfall readings for the applicable month.

h) The extent of any extension of time which may be granted to the Contractor in respect of wet climatic conditions (whether normal or abnormal) shall be determined as the algebraic sum of the "V" values for each month between the Commencement Date and the Due Completion Date of the Contract, calculated using the formula above; provided always that:

(i) rainfall occurring within the period of the Contractor's Christmas shut-down period (referred to in the Conditions of Contract) shall not be taken into account in the calculation of the monthly "V" values;

(ii) rainfall occurring during any period during which the Contractor was delayed due to reasons other than wet climatic conditions on the Site, and for which delay an extension of time is granted by the Employer's Agent, shall not be taken into account in the calculation of the monthly "V" values;

(iii) if the algebraic sum of the "V" values for each month is negative, the time for completion will not be reduced on account of subnormal rainfall, and

(iv) where rainfall is recorded only for part of a month, the "V" value shall be calculated for that part of the month using pro rata values for Nn and Rn.

i) The Employer's Agent shall, simultaneous with granting any extension of time in terms of this clause, revise the Due Completion Date of the Contract to reflect an extension of time having been granted in

j) respect of wet climatic conditions, to the extent of the algebraic sum of all the "V" values for all the preceding months of the Contract, less the aggregate of the "Nn" values for the remaining (unexpired) months of the Contract (viz less aggregate of the potential maximum negative "V" values for the remaining Contract Period). Thus, provided that where such period is negative, the Due Completion Date shall not be revised.

k) Any extension of time in respect of wet climatic conditions granted in terms of this clause shall not be deemed to take into account delays experienced by the Contractor in repairing or reinstating damage to or physical loss of the Works arising from the occurrence of abnormal climatic conditions. Extension of time in respect of any such repairs or

reinstatement regarding damage shall be the subject of a separate application for extension of time in accordance with the provisions of Clause 5.12 and Clause 10 of the Conditions of Contract.

MONTH	**N_n**	**R_n**
January	1.8	103.8
February	1.7	84.8
March	1.8	92.5
April	1.0	57.3
May	0.5	21.6
June	0.3	9.7
July	0.3	18.2
August	0.2	25.8
September	0.4	39.0
October	1.2	53.0
November	1.9	86.8
December	1.8	84.1
TOTAL	**13**	**676.6**

C3.4.3 PLANT AND MATERIALS

C3.4.3.1 Plant and materials supplied by the Employer

The Employer will not provide any plant. The Contractor shall provide all plant of whatever nature necessary to enable him to undertake the works as specified.

C3.4.3.2 Materials, Samples and Shop Drawings

Materials or work, which does not conform to the approved samples submitted in terms of Clause 7.4.1 (GCC 2015) of the Conditions of Contract, will be rejected. The Employer's Agent reserves the right to submit samples to tests to ensure that the material represented by the sample meets the specification requirements.

The costs of any such test conducted by or on behalf of the Employer's Agent, the results of which indicate that the samples provided by the Contractor do not conform to the requirements of the Contract, shall, in accordance with the provisions of Clause 7 of the Conditions of Contract, be for the Contractor's account.

C3.4.4 CONSTRUCTION EQUIPMENT

C3.4.4.1 Requirements for equipment

All construction plant and equipment used on this contract shall be in good working order, well maintained, of adequate size and fit for purpose. No plant or equipment that leaks oil, fuel or hydraulic fluids may be used on site.

Equipment must be such that work can be executed in an efficient manner.

Any plant or equipment that, in the opinion of the Employer's Agent, is not of adequate size or fit for use shall be removed from the site and replaced with acceptable plant and equipment, all at the Contractor's cost.

All equipment must comply with the requirements as stipulated in the Environmental regulations and specifications and contained in the OHS Act.

C3.4.4.2 Equipment provided by the Employer

The Employer shall not provide any equipment.

C3.4.5 EXISTING SERVICES

C3.4.5.1 Known services

The Contractor shall familiarise himself with all existing services and liaise with all relevant authorities for the location and detection of existing services.
No guarantee can be given that all affected services are indicated on the drawings, or that, if they are shown, they are shown exactly in the correct location. Once located, the exact location, level and nature of the service shall be recorded and given to the Employer's Agent's Representative in writing.

The Contractor shall, subject to the provisions of PSA 5.4, expose all services by hand in advance of his trenching operation in order to reduce the risk of damage to existing services.
The Contractor shall take special care not to damage any existing services and shall comply with all the requirements of the relevant authorities during construction. The Contractor will be held solely responsible for the protection of all known services and for any claims for damages arising from damage to any such service. (See also PSA 5.4).

C3.4.5.2 Treatment of existing services

The Contractor to ensure that existing services supply are not interrupted. All existing services have to remain operational, either through protection or re-routing. Temporary re-routing of existing services is allowed, with the approval of the owner of the service.

C3.4.5.3 Use of detection equipment for the location of underground services

The Contractor to make use of the necessary detection equipment to determine the location of an existing service, before excavation commences to expose the service.

C3.4.5.4 Damage to services

The Contractor shall take special care not to damage any existing services and shall comply with all the requirements of the relevant authorities during construction. The Contractor will be held solely responsible for the protection of all known services and for any claims for damages arising from damage to any such service. (See also PSA 5.4).

Damage that occurs to unknown services during construction will be paid by the Employer.

C3.4.5.5 Reinstatement of services and structures damaged during construction

The Contractor will be responsible for the repair and reinstatement of damaged services in compliance with the service owner's specifications.

C3.5. MANAGEMENT OF THE WORKS

C3.5.1 SPECIFICATIONS

The following Specifications are applicable:

(i) The SANS 1200 Standardised Specifications listed in C3.7.1.
(ii) The Particular Specifications given in C3.7.2; and
(iii) The Variations and Additions to the SANS 1200 Standardised Specifications given in C3.7. 3.

C3.5.2 PLANNING AND PROGRAMME

C3.5.2.1 General

The Contractor's Programme to be submitted in terms of Clause 5.6.1 of the Conditions of Contract shall take all matters that may impact the Contractor's sequence of executing the various components of the Works and the requisite rate of progress of the Works, as may be specified in or reasonably inferred from the Contract.

C3.5.2.2 Format

The Construction Programme to be submitted by the Contractor in accordance with the provisions of Clause 5.6.1 of the Conditions of Contract shall;

(a) Be in the form of a bar chart; and
(b) Clearly indicate the start and end dates and duration of all construction activities and identify the critical path; and
(c) Take full cognizance of all the Contractor's risks and obligations in terms of the Contract.

The said Programme and all revisions thereto shall also be provided to the Employer's Agents in electronic digital format using the MS PROJECT software on a Monthly basis as per Clause 5.6.4.

C3.5.2.3 Failure to maintain construction programme

If the Construction Programme has to be revised in terms of the Conditions of Contract, because the Contractor is falling behind in its programme, the Contractor shall submit a revised programme of how it intends to regain lost time to ensure completion of the Works before the Due Completion Date.

C3.5.2.4 Additional Programming Information

The following (but not limited to) programming information shall be incorporated into the Contractor's initial programme and all subsequently adjusted programmes. The Contractor's programme shall also take full account of the matters described in the sub-clauses hereunder. No additional payments will be made to the Contractor in respect of any additional costs as it may incur in consequence of arranging or adjusting its programme to accommodate the said matters and the Contractor's various tendered rates and prices shall be deemed to fully inclusive of such costs.

(a) Time related items, in respect of the following:
  (i) Time to submit documentation before commencing to carry out the Works – refer to Clause 5.3.1 C1.2 of Contract Data
  (ii) Construction Regulations, 2014 requirements:
    - Regulation 3, Construction work permit process period
    - Regulation 4, notification of construction works period
  (iii) Due Completion Date

(b) All special non-working days defined in the Contract Data.
(c) Contractor's annual shutdown period between December and January
(d) Allowance for a 30 – day float period in the programme for unforeseen circumstances
(e) Meeting the requirements of the Environmental Management Plan
(f) The time needed for preparation and approval of the various mix designs specified in the relevant construction sections of the Scope of Works.

C3.5.3 QUALITY PLANS AND CONTROL

Refer the various and applicable SANS/SABS specifications, the general health and safety specifications and subsequent health and safety plan, the Conditions of Contract as well as the various clauses within the Scope of Work.

The Contractor to submit the Quality Management Plan for the approval by the Employer's Agent before commencing any work.

C3.5.4 ENVIRONMENTAL MANAGEMENT

The Contractor will be responsible for managing his activities so that damage to the environment is minimised, as per the approved Environmental Management Plan contained in Specification PEM. A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance and provision of the Method Statement.

C3.5.5 FORMAT OF COMMUNICATIONS

All contractual communication shall be in writing.

The Contractor shall, for the full duration of the Contract Period, supply and maintain the following documentation:

(a) Site Communication and Request Book.
(b) Safety File containing all relevant safety data.
(c) Daily register of all labour, plant and equipment.
(d) Quality Control file containing all quality control/assurance forms and records.
(e) One full set of Contract Drawings and documents.
(f) Latest revision of the Construction Programme.

The above-mentioned shall be kept on Site and shall be accessible to the Employer's Agent at all times.

C3.6. HEALTH AND SAFETY

The Contractor will be responsible for managing his health and safety activities as per the approved Health and Safety Plan, as indicated in Specification PHS. A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014

C3.6.1 HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES

(a) Construction Regulations, 2014

The Contractor shall be required to comply with the Occupational Health and Safety Act, 1993: Construction Regulations, 2014 (the regulations) as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113 of 7 February 2014 including COVID-19 requirements. Non-compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

The proposed type of work, materials to be used and potential hazards likely to be encountered on this Contract are detailed in the Project Specifications, Bill of Quantities and Drawings, as well as in the Employers' health and safety specifications (regulation 5(1)(b)) of the Construction Regulations 2014, which are bound in the Contract document.

The Contractor shall in terms of regulation 7(1)(a) provide a comprehensive Health and Safety Plan detailing his proposed compliance with the regulations, for approval by the Employer.

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

A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

C3.6.2 PROTECTION OF THE PUBLIC

The Contractor to ensure the sufficient screening and barricading of the site of works is done to prevent unauthorised public access. If screening/barricading will impact on the movement of the public, the Contractor is to ensure that safe detour routes are allowed and clearly indicated.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014.

C3.6.3 BARRICADES AND LIGHTING

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014.

C3.6.4 TRAFFIC CONTROL ON ROADS

The Contractor shall carry out, erect and maintain such temporary works and provide all temporary road signs, pipes, deviations, warning boards, barricades, signs, lighting and

demarcations and the like, as are necessary to maintain and safeguard the normal flow of public and private vehicular and pedestrian traffic.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014

C3.6.5 MEASURES AGAINST DISEASE AND EPIDEMICS

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014. The Contractor also needs to refer to the Health and Safety Specification and the COVID-19 specification included as Specification PHS to this document for measures to be deployed on site.

C3.6.6 AIDS AWARENESS

The Contractor is required to refer to SANS 1921 – 6 as further amended below and HIV/AIDS Awareness Education Specification (Appendix D). Payment items have been included in the Schedule of Quantities to ensure compliance.

SANS 1921-6	
Variations	
Clause	Specification Data
1 e)	Appointment of an HIV / AIDS Awareness Champion.
4.1 f)	Appointing an HIV/ AIDS Awareness Champion within 14 days of site handover from amongst the workers (which could include the Community Liaison Officer). The champion should be able to speak, read and write English, speak and understand the local languages spoken by the Workers and shall be on site at all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available and has the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner. The Awareness Champion shall be responsible for: • Liaising with the Service Provider to assist in organising awareness workshops; • Filling condom dispensers and monitoring condom distribution; • Handing out information booklets; • Placing and maintaining posters
4.1 g)	Provide information about the names of the closest service providers to be displayed on a poster of size not smaller than A2.
4.2.3 c)	Understand and communicate the purpose of voluntary HIV/AIDS testing and counselling.
4.2.3 d)	Recognise the importance of caring for people living with HIV/AIDS and be familiar with the various treatments available, including treatment of opportunistic infections.
4.2.3 e)	Understand and communicate the rights and responsibilities of those living with HIV/AIDS in the workplace and the importance of non-discrimination.
4.3.2	The HIV/AIDS Awareness Champion and the Employer's representative shall certify the report and schedule described in 4.3.1 whenever a claim for payment is issued to the Employer.
5	Sanctions

	In the event that the Contractor fails to satisfy the requirements of this specification, the Employer may apply sanctions which include the rejection of claims for payment as being incomplete or the withholding of completion certificates (interim or final).

C3.7. PROJECT SPECIFICATIONS

PART A: CIVIL WORKS

C3.7.1 LIST OF APPLICABLE SPECIFICATIONS

C3.7.1.1 Applicable SANS 1200 Standardised Specifications

For the purpose of this Contract the latest issues of the following Standardised Specifications for Civil Engineering Construction, applicable at the date of the tender advertisement shall apply:

SANS 1200 A:	GENERAL
SANS 1200 AB:	EMPLOYER'S AGENT'S OFFICE
SANS 1200 C:	SITE CLEARANCE
SANS 1200 D:	EARTHWORKS
SANS 1200 DB:	EARTHWORKS (PIPE TRENCHES)
SANS 1200 DK:	GABIONS AND PITCHING
SANS 1200 G:	CONCRETE (STRUCTURAL)
SANS 1200 HA:	STRUCTURAL STEELWORK (SUNDRY ITEMS)
SANS 1200 L:	MEDIUM-PRESSURE PIPELINES
SANS 1200 LB:	BEDDING (PIPES)
SANS 1200 LE:	STORMWATER DRAINAGE

Any reference to a SABS standard, in any context or forum, will be deemed to be a reference to the corresponding SANS standard, and vice versa. Any ambiguity in relation to the standard specifications to be referred to the Employer's Agent for clarity, in terms of the GCC 2015 3rd edition.

The term "project specifications" appearing in any of the SANS 1200 standardised specifications must be replaced with the term "Scope of Work"

C3.7.1.2 Particular Specifications

The following Particular Specifications for work not covered by the SANS 1200 Standardised Specifications are also included hereunder:

PC:	NO-FINES CONCRETE
PEM:	ENVIRONMENTAL MANAGEMENT
PHS:	HEALTH AND SAFETY

C3.7.2 VARIATIONS AND ADDITIONS TO SANS 1200 STANDARDISED SPECIFICATIONS

SANS 1200 A:	GENERAL
SANS 1200 AB:	EMPLOYER'S AGENT'S OFFICE
SANS 1200 C:	SITE CLEARANCE
SANS 1200 D:	EARTHWORKS
SANS 1200 DB:	EARTHWORKS (PIPE TRENCES)
SANS 1200 DK:	GABIONS AND PITCHING
SANS 1200 G:	CONCRETE (STRUCTURAL)
SANS 1200 HA:	STRUCTURAL STEELWORK (SUNDRY ITEMS)

SANS 1200 L: MEDIUM-PRESSURE PIPELINES
SANS 1200 LB: BEDDING (PIPES)
SANS 1200 LE: STORMWATER DRAINAGE

The following variations and additions to the SANS 1200 Standardised Specifications referred to shall apply to this Contract. The prefix “PS” indicates an amendment to SANS 1200. The prefix “PSA” indicates an amendment to SANS 1200 A, “PSDB” to SANS 1200 DB and so on. The letters and numbers following these prefixes respectively indicate the relevant Standardised Specification and clause numbers in SANS 1200 to which the variation or addition thereto applies.

An asterisk (*) placed next to a PS Subclause number denotes the inclusion of an additional Subclause for which no equivalent appears in SANS 1200.

The term “project specifications” appearing in any of the SANS 1200 Standardised specifications must be replaced with the term “Scope of Work”.

Further to the above it should be noted that where in a specific Standardised Specification reference is made to a Subclause in another Standardised Specification, any amendment or addition to the Subclause referred to, as provided for in the Specification, shall apply. The aforementioned shall also apply with respect to Clauses referred to in a Particular Specification.

PSA GENERAL

PSA 1 SCOPE

Replace the contents of Clause 1.1, including the notes, with the following:

"1.1 This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to Civil Engineering construction and building works contracts, as well as the requirements for the Contractor's establishment on the Site."

PSA 2 INTERPRETATIONS

PSA 2.3 DEFINITIONS

In the opening phrase, insert the words: "the definitions given in the Conditions of Contract and" between the words "specification" and "the following".

a) General

Add the following definitions:

'Employers' Agent' (Clause 1.1.1.16 of Conditions of Contract) shall have the same meaning and be synonymous with Engineer throughout the Contract documentation.

'General Items' (Clause 1.1.1.21 of Conditions of Contract) shall have the same meaning and be synonymous with Preliminary and General items.

"General Conditions and Conditions of Contract. The General Conditions of Contract specified for use with this Contract as amended in the Contract Data.

Specified As specified in the Standardised Specifications, the Drawings or the Scope of Work. "Specifications" shall have the corresponding meaning."

c) Measurement and payment

Replace the definitions for "Fixed charge", "Time-related charge" and "Value-related charge" with the following:

"Fixed charge. A charge that is not subject to adjustment on account of variations in the value of the Contract Price or the time allowed in the Contract for the completion of the work.

Time-related charge. A charge, the amount of which varies in accordance with the Time for Completion of the Works, adjusted in accordance with the provisions of the Contract.

Value-related charge. A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract."

PSA 2.4 ABBREVIATIONS

a) Abbreviations relating to standard documents

Add the following abbreviation:

"CKS: SANS Co-ordinating Specification."

PSA 3 MATERIALS

PSA 3.1 QUALITY

Where applicable, materials shall bear an official standardisation mark.

Add the following:

"Where proprietary materials are specified, it is to indicate the quality or type of materials or articles required, and where the terms "or similar approved" or "or approved equivalent" are used in connection with proprietary materials or articles, it is to be understood that the approval shall be at the sole discretion of the Employer's Agent."

"PSA 3.3* ORDERING OF MATERIALS

The quantities set out in the Bill of Quantities have been carefully determined from calculations based on data available at the time of its compilation but are to be considered as approximate quantities only. Before ordering materials of any kind the Contractor shall be solely responsible for determining, from the Drawings issued or approved by the Employer's Agent for construction purposes, the actual quantities of materials required for the execution of the Works. No liability or responsibility whatsoever shall be attached to the Employer or the Employer's Agent in respect of materials ordered by the Contractor except when ordered in accordance with the Drawings issued or approved by the Employer's Agent for construction purposes."

PSA 4 PLANT

PSA 4.1 SILENCING OF PLANT

Replace the contents of Clause 4.1 with the following:

"The Contractor's attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act (Act No. 85 of 1993) as amended.

The Contractor shall at all times and at its own cost, be responsible for implementing all necessary steps to ensure full compliance with such regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other Plant which would otherwise cause a noise level in excess of that specified in the said regulations.

Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise in order to comply with the said regulations."

PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

Add the following new paragraph before the existing paragraph in Clause 4.2:

"The Contractor's buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours."

Delete “and first-aid services” in the second paragraph of Clause 4.2 and add the following:

"The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 15 workmen, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The Contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil."

“PSA 4.3* RESTRICTION ON THE USE OF PLANT

Except for the type of plant, and to the extent permitted or approved by the Employer’s Agent, the Contractor shall use only hand tools and equipment in the construction of the Works, or portion(s) of the Works, that are required to be constructed using labour intensive methods.”

PSA 5 CONSTRUCTION

PSA 5.1 SURVEY

PSA 5.1.1 Setting out of the Works

The installed benchmarks shown on the Drawings shall be used by the Contractor for setting out the works.
Add the following paragraph:

"The Contractor shall be required to check and verify, prior to commencement of any construction work, all benchmarks and boundary reference pegs, as shown and detailed on the Drawings. Reference and benchmark pegs disturbed and/or removed during the construction period shall be replaced by a Professional Land Surveyor and the Contractor shall bear the cost of such replacement. Payment to check and verify the reference and benchmark pegs will be made in terms of PSA 8.8.5.

Where labour intensive work is specified, the Contractor shall be responsible for the setting out of the task work."

PSA 5.1.2 Preservation and replacement of survey beacons and pegs subject to the Land Survey Act

Delete from the second sentence "Before the commencement . . . . “to” . . . . apparently in their correct positions" and replace with the following:

"Immediately on taking over the site, the Contractor, in consultation and liaison with the Employer's Agent, shall search for all pegs and the Contractor shall compile a list of pegs that are apparently in their correct position."

Replace the third sentence of Clause 5.1.2 with the following:

"At completion of the Contract, the Contractor shall expose and mark all pegs that were listed at the commencement of the construction as being in order and the Contractor shall arrange with a registered Land Surveyor the replacement of pegs that have become disturbed or damaged. The Contractor shall, as a precedent to the issue of the Certificate of Completion, provide to the Employer's Agent, a certificate from the Registered Land Surveyor, certifying that all the pegs listed at the commencement of construction in accordance with the provisions of this Clause, have been checked and that those found to have been disturbed, damaged or destroyed have been replaced in their correct positions, all in accordance with the provisions of the said Act.

The costs of replacement and certification as aforesaid shall be entirely for the Contractor's account, provided always that the Contractor shall not be held liable for the cost of replacement of pegs which:

(a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the Permanent Works ; and

(b) the Contractor can prove beyond reasonable doubt and to the satisfaction of the Employer's Agent, were disturbed, damaged or destroyed by others beyond its control, and

(c) were in close proximity to the work and which would unavoidably be removed, subject to the Employer's Agent approval being given to remove such pegs."

Add the following:

PSA 5.1.3 As-built Survey

The Contractor shall supply the Engineer with as-built survey data for the entire works, including cover and invert levels, coordinates of manholes, reservoirs, chambers and structures, points of intersection, etc. The Certificate of Completion will not be issued until the as-built survey data has been approved by the Engineer.

PSA 5.2 WATCHING, BARRICADING AND LIGHTING AND TRAFFIC CROSSINGS

Add the following:

"The Contractor shall comply in all aspects with the requirements of the Occupational Health and Safety Act (Act 85 of 1993), refer also PSA 5.7, PSA 5.9 and PSA 5.10."

PSA 5.3 PROTECTION OF STRUCTURES

Replace:" Machinery and Occupational Safety Act, 1983, (Act No. 6 of 1983)" with: "Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended," and insert the following after "(Act No. 27 of 1956)": "as amended".

PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

Replace the heading and the contents of Clause 5.4 with the following:

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

PSA 5.4.1 Location of existing services

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent Contractor to be present on, under, over or within the Site.

Without in any way limiting its liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Employer's Agent, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where it intends to work.

Neither the Employer nor the Employer's Agent offer any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site. No excavation may commence until the position of the service at the crossing point has been marked out and verified by an official of the responsible authority.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the Employer's Agent, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the requirements of Clauses 4.4 and 5.1.2.2 of SANS 1200 D (as amended) shall also apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans, but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the Site.

All services, the positions of which have been determined as aforesaid at critical points, shall henceforth be designated as "Known Services" and their positions shall be indicated by the Contractor on a separate set of Drawings, a copy of which shall be furnished to the Employer's Agent without delay.

As soon as any service which has not been identified and located as described above is encountered on, under, over or within the Site, it shall henceforth be deemed to be a "Known Service" and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the Site shall apply. The Contractor shall notify the Employer's Agent immediately should any such service be encountered or discovered on the Site.

Whilst it is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to:

(a) Known Services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognisance being taken of such deviations in line and level which may reasonably be anticipated; and

(b) any other service which ought reasonably to have been a Known Service in accordance with the provisions of this Clause;
as well as for consequential damage, whether caused directly by the Contractor's operations or by the lack of proper protection; provided always that the Contractor will not be held liable in respect of damages occurring to services not being Known Services.

No separate payment will be made to the Contractor in respect of any costs incurred in preparing and submitting to the Employer's Agent, the Drawings as aforesaid and these costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor's in respect of exposing services at the positions agreed by the Employer's Agent and as described above will be made under the payment items (if any) as may be provided therefore in the respective sections of the Specifications pertaining to the type of work involved.

PSA 5.4.2 Protection during construction

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all known services during the period which the Contractor has occupation and/or possession of the Site.

Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising there from to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

Unless otherwise instructed by the Employer's Agent, no services shall be left exposed after its exact position has been determined and all excavations carried out for the purpose of exposing underground services shall be promptly backfilled and compacted. In roadways, the requirements of subclause 5.9 of SANS 1200 DB should be observed. In other areas compaction is to be to 90% modified AASHTO density.

PSA 5.4.3 Alterations and repairs to existing services

Unless the contrary is clearly specified in the Contract or ordered by the Employer's Agent, the Contractor shall not carry out alterations to existing services. When any such alterations become necessary, the Contractor

shall promptly inform the Employer's Agent, who will either make arrangements for such work to be executed by the owner of the service or instruct the Contractor to make such arrangements himself.

Should damage occur to any existing services, the Contractor shall immediately inform the Employer's Agent, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted by the Contractor, unless approved by the Employer's Agent.

The Employer will accept no liability for damages due to a delay in having alterations or repairs effected by the respective service owners. The Contractor shall provide all reasonable opportunity, access and assistance to persons carrying out alterations or repairs of existing services."

PSA 5.8 GROUND AND ACCESS TO THE WORKS

Add the following:

The Contractor shall further, before commencement of any of the Works, compile a photographic / video recording of all the existing roads, structures, fences, gates, pipeline routes and trees which may be affected during the Works.

Payment will be made in terms of PSA 8.3.2.2 and PSA 8.4.2.3."

"PSA 5.9* MAINTAINING SERVICES IN USE

The Contractor shall take note that he shall not cut off any service in use without the prior approval of the Employer's Agent.

Failure on the part of the Contractor to comply with any of the above provisions will constitute sufficient reason for the Employer's Agent to stop the works until the situation has been remedied, or should he deem it necessary, arrange for the situation to be remedied at the Contractor's cost.

No direct payment will be made for the cost of maintaining services in use. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

"PSA 5.10* DEALING WITH AND ACCOMMODATING TRAFFIC

The Contractor shall take note that the existing roads and tracks within and to the Sites shall remain operational throughout the contract period. To this end the Contractor shall provide and maintain all temporary fences, security, barriers, kerb ramps, signs, markings, flagmen, drums, lighting, personnel and all other incidentals necessary to ensure safe and easy passage of all traffic.

Temporary traffic signs etc. as well as all necessary markings shall be erected and maintained by the Contractor and the number and layout of the traffic signs shall comply with the Site Manual entitled "Safety at Roadworks in Urban Areas", as published by the Department of Transport.

Traffic signs shall have a yellow background with either a red / black border.

No direct payment will be made for the cost of dealing with and accommodating traffic. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the contract. Further, the provision of PSA 5.2 shall apply."

"PSA 5.11* SITE MEETINGS

The Contractor's authorised Construction Manager and Contracts Manager will be required to attend regular site meetings, which shall normally be held once a month on dates and at times determined by the Employer's Agent, but in any case, whenever reasonably required by the

Employer's Agent. Unless otherwise indicated in the Contract or instructed by the Employer's Agent, such meetings shall be held at the Contractor's offices on the Site. At such monthly meetings, matters such as general progress on the Works, quality of work, problems, claims, payments, and safety etc, shall be discussed, but not matters concerning the day-to-day running of the Contract.

"PSA 5.12***** PROVIDING ACCESS TO ERVEN AND PROPERTIES

Access to erven and properties along the route of trenches and roads shall be provided by the Contractor at all times. To this end suitable crossings shall be constructed where required.

Temporary crossings shall be in the form of portable bridges, temporary backfill or other approved means and shall be capable of permitting the safe passage of all vehicles and pedestrians. The Contractor shall also be responsible for maintaining crossings and for removing same when they are no longer required.
If as a result of restricted road reserve widths and the nature of the Works the construction of bypasses is not feasible, construction shall be carried out under traffic in order to provide access to the properties.

The Contractor may, with the approval of the Employer's Agent, arrange with the occupiers of the affected properties to temporarily close off a portion of a road, footpath entrance, property access road or other access, provided that the Contractor shall give due notice of the intended closure and its probable duration to the occupiers and shall as punctually as possible re-open the route at the prescribed time. Where possible, roads shall be made safe and re-opened to traffic overnight. Any such closure shall be an arrangement between the Contractor and the occupiers and shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs and drums shall be provided by the Contractor to suit the specific conditions.

No direct payment will be made for the cost of providing access. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

"PSA 5.14* PROTECTION OF LIVESTOCK

From the time of the occupancy of the Site until the date of the Completion Certificate the Contractor shall take all measures necessary for the protection and control of livestock on the sections of the properties affected by his operations. He shall provide gates in existing fences cut by him for the purpose of access and control, and where necessary, to store materials and plant and the Contractor shall ensure that all gates are kept closed during such time as they are not actually in use by his traffic.

Where the Contractor cannot make alternative arrangements, the Contractor shall erect temporary fencing where necessary to protect livestock exposed to straying through his operations. The fencing shall be maintained in good order during construction operations and on completion of the work it shall be removed from the Site and all surfaces restored to the satisfaction of the property owner.

Payment for the protection of livestock, including the erection of temporary fences and gates where required, shall be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract.

Claims by property owners for loss of or injury to livestock due to negligence on the part of the Contractor, shall be settled by the Contractor."

"PSA 5.15* COMMUNITY LIAISON OFFICER (CLO) MEASUREMENT AND PAYMENT

Employment process for CLO and payment as detailed in Clause/Section C1.3 and C1.4."

"PSA 5.16* GRADUATE ENGINEER MEASUREMENT AND PAYMENT

Employment of Graduate Engineer (COW) and payment shall be as detailed in Clause/Section C1.3 and C1.4."

PSA 6 TOLERANCES

''PSA 6.4* USE OF TOLERANCES

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified, or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorised' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Employer's Agent, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorised' dimensions.

If the work is constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the calculation of quantities will be based on the 'authorised' dimensions, regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Employer's Agent may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be calculated based on the actual dimensions as constructed.''

PSA 7 TESTING

PSA 7.1 PRINCIPLES
PSA 7.1.2 Standard of Finished Work Not to Specification

Insert the words "or checks by an approved laboratory ..." after the words "Where the Employer's Agent checks ..."in the first line of Clause 7.1.2.

PSA 7.2 APPROVED LABORATORIES

Replace the contents of Clause 7.2 with the following:

“Unless otherwise specified in the relevant specification or elsewhere in the Scope of Work, the following shall be deemed to be approved laboratories in which design work, or testing required in terms of a specification for the purposes of acceptance by the Employer’s Agent of the quality of materials used and/or workmanship achieved, may be carried out:

(a) any testing laboratory certified by the South African National Accreditation Systems (SANAS) in respect of the nature and type of testing to be undertaken for the purposes of the Contract;

(b) any testing laboratory owned, managed or operated by the Employer or the Employer’s Agent;

(c) any testing laboratory established and operated on the Site by or on behalf of the Employer or the Employer’s Agent;

(d) any testing laboratory designated by the Employer’s Agent.”

PSA 8 MEASUREMENT AND PAYMENT

PSA 8.1 MEASUREMENT

PSA 8.1.1 Method of measurement, all sections of the Schedule
Delete the words "and South West Africa".

PSA 8.1.2 Preliminary and General item or section
PSA 8.1.2.1 Contents

Replace the contents of item (c) with the following:

"The 'duration of construction' applicable to a time-related item shall be the tendered contract period for the total works, plus as applicable, the Civil Engineering Industry Holiday (Dec / Jan) and all gazetted public holidays for the Civil Engineering Industry."

REPLACE THE LAST SENTENCE OF SUBCLAUSE 8.1.2.1(B) WITH THE FOLLOWING:

"Separate items will be scheduled to cover the fixed, value-related and time-related components of the Contractor’s General items (clause 1.1.1.21 of the Conditions of Contract) in respect of:

(a) Construction work period:

The number of days for reaching the Due Completion Date (Clause 1.1.1.14 of the Conditions of Contract), being the number of days for achieving Practical Completion of the Works, as specified in the Contract Data and as adjusted by such extensions of time or acceleration as may be allowed in terms of Contract.

(b) Construction Work Permit process period (if applicable):

The actual number of days that the Employer or his agent (in terms of the Construction Regulations, 2014) takes to process and issue the instruction to commence with the

Works (Clause 5.3.3.2 of the Conditions of Contract, as amended) from the date of submission of the documentation referred to in Clause 5.3.1 of the Conditions of Contract.

PSA 8.1.2.2 Tendered sums

Replace the contents of this Sub-Clause with the following:

"Except only where specific provision is made in the Specifications and/or the Bill of Quantities for separate compensation for any of these items, the Contractor's tendered sums under items PSA 8.3.1 and PSA 8.4.1 shall collectively cover all charges for:

- risks, costs and obligations in terms of the Conditions of Contract and of this standardised specification; and
- head-office and site overheads and supervision; and
- profit and financing costs; and
- expenses of a general nature not specifically related to any item or items of the permanent or temporary work; and
- providing such facilities on site as may be required by the Contractor for the proper performance of the Contract and for its personnel, including, but without limitation, providing offices, storage facilities, workshops, ablutions, services such as water, electricity, sewage and rubbish disposal, access roads and all other facilities required, as well as for the maintenance and removal on completion of the works of these facilities and cleaning-up of the site of the Contractor's establishment and reinstatement to not less than its original condition, and
- providing the facilities for the Employer's Agent and his staff as specified in the Contract and their removal from the site on completion of the Contract.
- completion of monthly reporting template forms (Refer to Appendix B for Pro Formas)"

PSA 8.2 PAYMENT

PSA 8.2.1 Fixed-charge and Value-related items

Replace the contents of Clause 8.2.1 with the following:

"Payment of fixed charges in respect of Clause 8.3.1 (Contractual requirements) will be made as follows:

(a) EIGHTY PERCENT (80%) of the sum tendered will be paid when the facilities have been provided and approved; and

(b) The remaining TWENTY PERCENT (20%) will be paid when the Works have been completed, the facilities have been removed and the site of the Contractor's establishment has been cleared and cleaned to the satisfaction of the Employer's Agent.

No adjustment will be made to the sum tendered in respect of item 8.3.1 should the value of the Works finally executed, or the Time for Completion vary in any way from that specified in the Tender.

The fixed charged items will include all associated cost to deal with the compulsory sub-contracts, other than cost already included under clause 8.3.1.

Payment for the sum tendered under clause 8.3.2 (Establishment of facilities on site) will be made in three separate instalments as follows:

(a) The first instalment, which is 40% of the sum, will be paid when the Contractor has fulfilled all its obligations to date under this Specification, the General Conditions of Contract and the Special Conditions of Contract, and when the value of work certified for payment, excluding materials on Site and payments for preliminary and general items, is equal to not less than 5% of the total value of the work listed in the Schedule of Quantities.

(b) The second instalment, which is 40% of the sum, will be made when the amount certified for payment, including retention monies but excluding this second instalment, exceeds 50% of the Tender Sum.

(c) The final payment, which is 20% of the sum, will be made when the Works have been certified as completed and the Contractor has fulfilled all its obligations to date under this Specification, the General Conditions of Contract and the Special Conditions of Contract.

Should the value of the measured work finally completed be more or less than the Tender Sum, the sum tendered under clause 8.3.2 will be adjusted up or down in accordance with the provisions of Clause 7.8 of the Conditions of Contract, and this adjustment will be applied to the third instalment.

The fixed charged items will include all associated cost to deal with the compulsory sub-contracts, other than cost already included under clause 8.3.2."

PSA 8.2.2 Time-related items

Replace the contents of Clause 8.2.2 with the following:

"Subject to the provisions of subclauses 8.2.3 and 8.2.4, payment under item PSA 8.4.1 (time-related preliminary and general charges) will be made as follows:

(a) Construction work period:

Payment shall be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the number of days stated in Contract Data (Clause 1.1.1.14) in months.

Payment for this item shall be inclusive of the time specified in Clause 1.1.1.14 plus any Extension of Time for Practical Completion but shall exclude all days included in PSA 8.2.2(b) and PSA 8.2.2(c).

(b) Construction work permit process period (if applicable):

Payment shall be for the actual number of days it takes the Employer or his agent (in terms of the Construction Regulations, 2014) to process and obtain a construction work permit (if applicable) after the submission of documentation contemplated in Clause 5.3.1 of the Conditions of Contract. The number of days stated in the Contract Data is for tendering purposes only and shall not be used as an entitlement to substantiate any claim.

The daily rate shall be fully inclusive of all costs associated with this period (refer Programme – Scope of Works) and no claim for additional cost will be considered.

The Contractor shall note that any EoT during this period will be extended by the number of days and will be compensation for at the rate priced for in the BOQ."

provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the Works as a whole.

Should the Employer's Agent grant an extension of time for the completion of the total works, the Contractor will be entitled to an increase in the sums tendered for time-related items, which increase shall be in the same proportion to the original tendered sums, as the extension of time is to the duration of construction as defined in PSA 8.1.2.1. The Contractor shall however note that the aforementioned will not apply to extensions of time granted in terms of PSA 8.4.6.

Payment of such increased sums will be taken to be as full compensation for all additional preliminary and general costs, either time-related costs or fixed costs that result from the circumstances pertaining to the extension of time granted."

The payment to the Contractor for Time-Related Items shall be adjusted in accordance with the following formula in the event of the Contract being extended by means of a Variation Order (VO):

$$\textit{Sum of Tendered amounts for Time Related Items} \times \frac{\textit{Extension of Time authorised by VO}}{\textit{Tender Contract period}}$$

For the purposes of applying this formula "Extension of Time" will exclude the Contractor's December / January close-down period, if applicable.

The abovementioned adjustment of the payment for Time-Related Items shall be made in the completion Payment Certificate and shall be the only payment for additional Time-Related costs irrespective of the actual period required to complete the Contract including its authorised extensions.
In the case of fixed price contracts, the amount by which the Time-Related Items is adjusted shall not be subject to the Contract Price Adjustment formula.

In the case of contracts subject to Contract Price Adjustment the amount by which the time-related items are adjusted shall be subject to the Contract Price Adjustment formula."

PSA 8.3 SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS

REPLACE THE CONTENTS OF SUBCLAUSE 8.3.1 WITH THE FOLLOWING:
"PSA 8.3.1 Fixed preliminary and general charges. Unit: sum

The sums tendered shall include full compensation for all fixed-charge preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.1.1.

PSA 8.3.2 Value-related preliminary and general charges. Unit: sum

The sums tendered shall include full compensation for all value-related preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.1.2."

“PSA 8.3.2.1 Facilities for the Employer’s Agent as specified in PSAB .....Unit: sum”

“PSA 8.3.2.2 Facilities for the Employer’s Agent as specified in PSA & PSAB .....Unit: sum”

PSA 8.4 SCHEDULED TIME-RELATED ITEMS

PSA 8.4.1 Contractual requirements .....Unit: Sum

REPLACE THE CONTENTS OF SUBCLAUSE 8.4 WITH THE FOLLOWING:

"PSA 8.4.1 Time-related preliminary and general charges

The sum tendered shall include full compensation for all time-related preliminary and general charges as described in subclause PSA 8.1.2.2. Payment will be made as described in subclause PSA 8.2.2."

(a) Construction work period ..... Unit: sum

(b) Construction work permit process period (if applicable) .....Unit: days

“PSA 8.4.2.1 Facilities for the Employer’s Agent as specified in PSAB .....Unit: sum”

“PSA 8.4.2.2 Facilities for the Employer’s Agent as specified in PSA & PSAB .....Unit: sum”

"PSA 8.4.6* Compensation in terms of Subclause 5.12.2.4 and Clause 9 of the Conditions of Contract for delays incurred:

(a) Plant.....Unit: Sum per working day
(b) Labour.....Unit: Sum per working day
(c) Supervision .....Unit: Sum per working day
(d) Other services, facilities etc. not covered by (a), (b) and (c) .....Unit: Sum per working day

The sum tendered for each item shall cover the full and final standing cost per day of delaying the specified resource or facility and no additional compensation shall apply, notwithstanding any provisions to the contrary in the contract documents, or in respect of any extension of time granted in relation to the circumstances described in Subclauses5.12.2.4 and 9 of the Conditions of Contract.
For the purposes of calculating the total delay, a working week shall be held to consist of five working days and a working day 9 hours.

Payment for the partial standing of any of the scheduled resources for a day or part thereof, or the standing of a complete resource for a part day, will be made pro-rata in proportion to an appropriate factor assessed by the Employer’s Agent.

The amount by which compensation for delays is adjusted shall be subject to the contract price adjustment formula as defined in the Conditions of Contract.

This payment item shall only apply to delays which in the opinion of the Employer's Agent are due to the circumstances described in Subclauses 5.12.2.4 and 9 of the Conditions of Contract. No Payment will be made for any salary related or other internally caused strikes. The cost of delays incurred for all other circumstances shall be treated as provided for in the Conditions of Contract.

The provision of this Clause shall in no way prejudice the right of either the Employer or the Contractor to determine the Contract in terms of the provisions of Clause 9 of the Conditions of Contract.

The Contractor shall take note that no payment will be considered for any additional cost incurred in protecting his plant and site establishment, as well as for costs incurred in respect of damage to constructional plant and equipment."

PSA 8.5 SUMS STATED PROVISIONALLY BY THE EMPLOYER'S AGENT

Replace the contents of Clause 8.5 with the following:

"PSA 8.5.1 Works Executed by the Contractor ..... Unit: Prov Sum

The Contractor will be reimbursed in substitution of the Provisional Sums (if any) allowed in the Bill of Quantities for work to be executed by the Contractor, in the amounts determined in accordance with the provisions of Clause 6.6 of the Conditions of Contract.

Replace Clause 8.6 with the following:

"PSA 8.6 PRIME COST ITEMS

PSA 8.6.1 Prime Cost Sums

(a) Description of Item to which Prime Cost Sum Applies..... Unit: PC Sum
(b) Charge Required by Contractor on Sub-item (a) above..... Unit: %

Sub-items (a) and (b) will be provided in the Bill of Quantities for each different item to which a Prime Cost Sum applies.

The Contractor shall be reimbursed under sub-item(s) (a) in substitution of the respective Prime Cost Sums included in the Contract, the actual price(s) paid or payable by him in respect of the goods, materials or services supplied, but excluding any charges for the Contractor's labour, profit, carriage, establishment or other charges related to such goods, services or materials.

The Contractor shall be paid under sub-item (b), the respective percentage, as stated by the Contractor in its Tender, of the amount certified by the Employer's Agent for payment under the related sub-item (a). The percentages tendered by the Contractor for each respective sub-item (b) included in the Bill of Quantities shall be deemed to in full and final compensation to the Contractor in respect of any charge by the Contractor for labour, carriage profit, establishment and for any other charges related to the goods, services or materials supplied under the related sub-item (a).

If the Contractor shall have omitted within its Tender to insert a tendered percentage under sub-item (b), or tendered a zero percentage, the Contractor's tendered rate for sub-item (b) shall be deemed to be zero and the Contractor shall not be entitled to any payment under sub-item (b)."

Note:

1. Only payments for successful test will be made under the Prime Cost Sum provided in the Bill of Quantities for "additional acceptance control testing by the Employer's Agent".

2. The Contractor is responsible for the cost of process control testing. Payment in terms of the above will only be made for acceptance control testing ordered by the Employer's Agent.

"PSA 8.7 DAYWORK

Replace the contents of subclause 8.7 with the following:

"Measurement and payment shall be in accordance with the provisions of Clause 6.5 of the Conditions of Contract."

PSA 8.8 TEMPORARY WORKS

Replace the heading and contents of subclause 8.8.1 with the following:

PSA 8.8.2 Dealing with Traffic

Delete the entire Clause. The provision of PSA 5.10 shall apply. Refer also PSA 5.2, PSA 5.3, PSA 5.7 and PSA 5.10"

PSA 8.8.4 Existing services

Replace the heading of paragraph (c) with the following:

"(c) Excavate by hand in soft material to expose existing services ..... Unit: m^3

Add the following:

"The rate tendered for (c) shall further cover the cost of backfilling the excavation with excavated material compacted to 90% of modified AASHTO maximum density, loading, transporting within a free haul distance of 0,5 km and disposing of surplus material as directed, keeping the excavation safe, dealing with water, protecting the exposed services, and any other operation necessary to complete the work.

No distinction will be made between the various types of services to be exposed, or the depths to which excavations are taken.

Excavation in excess of that authorised will not be measured for payment."

PSA 8.8.5 Cost of survey in terms of Land Survey Act

Delete the entire Clause. The provision of PSA 5.10 shall apply.

"PSA 8.8.7 Dealing with water

(a) Dealing with subsurface water ..... Unit: Sum
(b) Dealing with surface water ..... Unit: Sum

The sum shall cover the cost for the provision, operation, maintaining and removal of all plant and materials required to deal with any water anywhere on site as required in terms of Sub clause 5.1.3 of SANS 1200 D and Sub clause 5.1.2 of SANS 1200 DB. No additional payment will be made for "Special water hazards".

The sum shall cover the cost of providing the necessary plant or materials, or both, fully erected and operative on the Site, the cost of operating and maintaining pumps, well points, sheeting, close timbering, and other equipment, as applicable, for 24 Hours a day, 7 days a week, throughout the period during which the facilities are required, and the cost of removing such goods and restoring the Site to its original condition on completion of that part of the project for which the temporary works were erected.

"PSA 8.8.8* Construct and remove temporary road to be used by the Contractor for haulage and access for the duration of the Contract .....Unit: Km

The Contractor shall determine the road width required, the necessary surface material, stormwater drainage and layerworks necessary to provide a durable and all-weather haul road.

The rate tendered shall cover the cost of all labour, plant and material necessary to construct and remove at the end of the Contract, the temporary haul road to be used by the Contractor for haulage and access to the reservoir Site.

No contractual claim or associated additional costs shall be evaluated, entertained or paid for any delays due to whatever circumstance incurred as a result of the construction, the use and the maintenance of haul or access roads."

PSA 8.9 WAYLEAVE Unit: sum

The tendered sum shall include full compensation to the Contractor for all the costs involved in obtaining all the necessary wayleaves required on the contract.

PSA 8.10 CONTRACT NAMEBOARDS Unit: No

The tendered sum shall include full compensation to the Contractor for all the costs involved in the supply, installation and maintaining of the specified number of contract nameboards as shown on the drawings, including the removal of the boards at the end of the contract period.

PSA 8.11 QUALITY MANAGEMENT PLAN Unit: sum

The costs of whatever nature for providing the Quality Management Plan as specified in Part C3 will be deemed to be covered by the sums tendered for the respective items in Section A of the Bill of Quantities.

PSA 8.12 PROVISION OF SECURITY PERSONNEL Unit: sum

The costs of whatever nature for providing security personnel the Contractor deems appropriate, taking cognisance of the location of the site, will be deemed to be covered by the sums tendered for the respective items in Section A of the Bill of Quantities.

PSA 8.13 EMPLOYMENT OF COMMUNITY LIAISON OFFICER Unit: Prov. Sum

The costs of whatever nature for Community Liaison Officers, taking cognisance of the location of the site, will be deemed to be covered by the sums tendered for the respective items in Section A of the Bill of Quantities.

PSA 8.14 EMPLOYMENT OF GRADUATE ENGINEER Unit: Prov. Sum

The costs of whatever nature for Graduate Engineer, taking cognisance of the location of the site, will be deemed to be covered by the sums tendered for the respective items in Section A of the Bill of Quantities.

PSA 8.15 SURVEY FOR AND PREPARATION OF AS-BUILT DATA Unit: sum

The sum tendered shall include all costs associated with providing the Engineer with the required as-built information of the works in terms of PSA 5.1.3.

PSAB EMPLOYER'S AGENT'S OFFICE

PSAB 3 MATERIALS

PSAB 3.1 NAMEBOARDS

Notwithstanding the provisions of this Sub-Clause, two Contract Nameboard shall be provided. The nameboard shall further comply with regards to size, painting, decorating and detail to Drawing number 1005270-0000-DRG-CC-601.

PSAB 3.2 OFFICEBUILDING(S)

Replace the words: 'as scheduled" in parenthesis in the first line of this Subclause with:

"as specified in Portion 1 of the Project Specification";

Replace 3.2d) with the following:
"d) Eight chairs"
And replace Subclause 3.2(j) with the following:

"(j) an air-conditioning unit capable of both heating in winter and cooling in summer."

Add the following items after j):

"k) 1 x Pin board to hold A0 drawing.

l) 1 x 110 ℓ refrigerator."

Add after "Employer's Agent" in the third last line:

"The minimum standard of toilet shall be the chemical type."

"PSAB 3.3* CARPORT

The Contractor shall provide on Site for the duration of the Contract three (3) number of carports for exclusive use of the Employer's Agent and his Representatives. Each car-port shall be constructed so that the vehicle parked under it is always protected against the direct rays of the sun. The carport area shall be at least 20m² and the floor shall be covered with a layer of crushed stone to alleviate dusty and muddy conditions. The carports shall be positioned so as to provide easy and convenient access to the Employer's Agent office."

"PSAB 3.3* PROTECTIVE CLOTHING

The Contractor shall provide and replace when necessary four sets of safety helmets, reflective jacket for use by Employers Agent & Employer visitors to site.

PSAB 4 PLANT

PSAB 4.1 TELEPHONE

Replace Sub-clause 4.1 of SANS 1200 AB with the following:

"One site telephone or two cellular telephone shall be made available to the Employer's Agent.

The Contractor shall, at its own cost, arrange for the provision thereof and the Contractor shall further provide associated service contracts from a reputable cellular service provider, for the exclusive use of the Employer's Agent and his staff. The Contractor shall further insure the cellular phones against loss or damage from whatever cause arising and shall ensure that all cellular phone accounts are promptly paid on the due dates for payment. The Contractor shall further, at its own cost, ensure the prompt repair of all cellular phones provided under this Clause, when reasonably required by the Employer's Agent."

"PSAB 4.2* ELECTRONIC EQUIPMENT

The Contractor will provide various items of electronic equipment for the exclusive use by the Employer's Agent and his site staff, to assist in the administration of the Contract, for the duration of construction. The electronic equipment includes a digital camera(s), software, a printer(s), scanner, GPS, and related consumables.
The Contractor shall also provide signal booster on the Site, to enable electronic devices that requires signal to function properly and maintain it for the duration of the Contractor.

The equipment shall always remain the property of the Employer's Agent, including upon completion of construction and the Contractor shall have no obligation other than the payment in terms of clause 8.6 of SANS 1200 and PSA 8.6.

"PSAB 4.3* SURVEY EQUIPMENT

The Contractor shall provide the following survey equipment for use by the Employer's Agent:

a) 1 x automatic level with tripod,
b) 1 x level staff with staff bubble,

c) 2 x ranging rods,
d) 1 x builder's spirit level of length 900 mm,
e) 1 x steel tape of length 50 m,
f) 1 x pocket tape of length 5 m,
g) 1 x steel level transfer plate,
h) 1 x measuring wheel, and
i) all steel and wood pegs, concrete, hammers, picks, etc., that the Employer's Agent may require.

The Contractor shall provide proof, at the start of the Contract, that the tacheometer and automatic level that have recently been serviced by an acceptable institution and shall, throughout the period of construction,

service and maintain all survey equipment and he shall insure same and indemnify the Employer and the Employer's Agent against all claims for loss, breakage or theft of such equipment.

All survey equipment shall be provided for the exclusive use of the Employer's Agent.
"PSAB 4.4* ACCOMMODATION FOR EMPLOYER'S AGENTSTAFF

The Employer's Agent will locate suitable accommodation for the Employer's Agent's Representative staff which shall be leased in the name of either the Contractor or Employer's Agent. The period of the lease shall extend until the end of the month in which the Completion Certificate is issued."

PSAB 5 CONSTRUCTION

PSAB 5.1 NAMEBOARDS

Replace the contents of this Clause with the following:

"The Contract Nameboards shall be erected within fourteen days of the Commencement Date and shall be placed where ordered. Any damage to this board shall be repaired within seven days of a written instruction issued by the Employer's Agent's Representative.

Further to the above the Contractor will not be allowed to erect more than two of his own nameboards in the area of the Works. The position of these shall be agreed to by the Employer's Agent. No payment will be made for the supply, erection or maintenance of the Contractor's nameboards and the Employer's Agent reserves the right to order the removal of the nameboards if not properly maintained.

All nameboards shall be removed within 7 days of the issue of the "Certificate of Completion".

PSAB 5.5 SURVEY ASSISTANTS

A survey assistant will be required from time to time to assist the Employer's Agent Representative.

PSAB 8 MEASUREMENT AND PAYMENT

Delete the contents of this Clause. The appropriate measurement and payment clauses have been included under Clause 8 of SANS 1200 A and PSA.

PSC 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 the various clearance items."

PSC 5 CONSTRUCTION

PSC 5.1 AREAS TO BE CLEARED AND GRUBBED

Add the following:

“Notwithstanding the above, the Employer’s Agent may, where particular areas are scarcely vegetated, order that the clearing and grubbing operation be totally or partially omitted, in which case no payment will be made under this section.

Payment will then only be made for excavation included under the relevant earthworks section.”

"Pipeline routes shall be cleared to a distance of between 1 - 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

PSC 5.2.3 Preservation of trees

PSC 5.2.3.2 Individual trees

REPLACE THE LAST SENTENCE WITH THE FOLLOWING:

"An amount of R100.00 will be deducted from moneys due to the contractor as a penalty for every tree that is damaged or removed unnecessarily."

PSC 5.5 RECLEARING OF VEGETATION

ADD THE FOLLOWING:

"Except if otherwise agreed, where areas have to be recleared on the written instruction of the Employer’s Agent, such reclearing shall be carried out at the Contractor’s own cost and the

Contractor is advised therefore, not to clear areas at such an early stage that reclearing may become necessary."

PSC 5.6 CONSERVATION OF TOPSOIL

ADD THE FOLLOWING:

"Conservation of topsoil, together with grass, roots and chipped mulch shall be applicable. Stockpiling of topsoil will be allowed on Site in specific locations indicated by the Employer's Agent. Topsoil shall not be stockpiled higher than 2,0m. Care shall be exercised to prevent the compaction of topsoil in any way especially by vehicles travelling over such material."

PSC 8.1 BASIC PRINCIPLES

ADD THE FOLLOWING:

"The thickness of the layer that will unavoidably be stripped during clearing of vegetation will be taken as 100 mm. This implies that levels used in earthworks quantity calculations will be 100 mm lower than the original levels excluding stripping of topsoil to stockpile where applicable."

ADD THE FOLLOWING:

"Levels to be used for earthworks quantity calculations will be surveyed once the clearing operation has been completed."

PSC 8.2 PAYMENT

PSC 8.2.1 Clear and grub

REPLACE THE FIRST LINE WITH THE FOLLOWING:

"The area designated by the Employer's Agent to be cleared and grubbed will be measured in square metre to the nearest metre or"

PSC 8.2.7 Dismantle, remove and reinstate pipelines, electricity transmission lines, cables, etc.

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH:

"The tendered rates shall include full compensation for the detection, disconnection, removal, stockpiling, safeguarding, reinstatement and reconnection of services, including all necessary excavation, bedding, concrete bases and backfilling.

In the event of the contractor damaging any of the services he will replace it at his own cost."

"PSC 8.2.11 Remove topsoil to spoil site furnished by Contractor ..... **Unit : m^3**

The tendered rate shall include full compensation for removing topsoil to a depth of 150 mm and for loading and transporting the material to spoil sites furnished by the Contractor.

PSC 8.2.12 Take down and re-erect existing fences ..... **Unit : m**

The rate shall cover the cost of taking down the fences, coiling wire, sorting, stacking and guarding all material, the cost of loading, transporting and off-loading such material, the cost of re-erecting the fence in its original position using the dismantled material and the cost of temporary bracing the sections of fence not taken down.
The rate shall also cover the cost of using new tying wire but not the cost of any other new material that may have to be used on the written instructions of the Employer's Agent, as such new material will be paid for under Particular Specification PA: FENCING.

PSC 8.2.13 Demolish existing wall and replace with Vibracrete wall Unit : m

The rate shall cover the cost of dismantling a section of wall and replacing it with a 2,1 m high Vibracrete wall. The rate shall also cover the cost of all excavation necessary and the disposal of all rubble.

PSC 8.2.14 Remove and dispose of kerbing Unit : m

The rate shall cover the cost of the removal and disposal of existing kerbs, including all necessary excavation.

PSC 8.2.15 Remove and reinstate existing:

(a) Kerbs/ Edging ..... Unit : m

The tendered rates shall include full compensation for the careful removal of kerbs or edging, the temporary stockpiling and cleaning thereof and the reinstatement once the work has been completed, including all necessary excavation, backfilling and concrete bedding and backing with 15 MPa concrete. In the event of the contractor damaging any of the kerbs, he will replace it at his own cost.

PSD EARTHWORKS

PSD 2 INTERPRETATIONS

PSD 2.1 SUPPORTING SPECIFICATIONS

Replace Clause 2.1.2 with the following:

"PSD 2.1.2: Any of the other SANS 1200 Specifications may form part of the Contract Documents."

PSD 2.3 DEFINITIONS

Replace the word and the definition for "borrow" with the following:
"**Borrow material**: Material, other than material obtained from excavations required for the Works, obtained from sources such as borrow pits or the authorised widening of excavations. 'Borrow' shall have a corresponding meaning."

Replace the definition for "specified density" with the following:

"**Specified density**: The specified dry density expressed as a percentage of modified AASHTO dry density."

Replace the definition for "stockpile" with the following:
"**Stockpile** (verb): The process of selecting and, when necessary, loading, transporting and off-loading material in a designated area for later use for a specific purpose."

Add the following definitions*:*

"**Commercial Source**: A source of material provided by the Contractor, not the Employer, and including any borrow pit, provided by the Contractor.

Fill: An embankment or terrace constructed of material obtained from excavations or borrow pits.

Fill (material): Material used for the construction of an embankment or terrace.

Roadbed: The natural in situ material on which the fill, or in the absence of fill, the pavement layers, are constructed."

PSD 3 MATERIALS

PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

PSD 3.1.1 Method of Classifying

Add the following:

"The classification of material other than 'soft excavation' shall be agreed upon before excavation may commence.

The Contractor shall immediately inform the Employer's Agent if and when the nature of the material being excavated changes to such an extent that a new classification is warranted for further excavation. Failure on
the part of the Contractor to advise the Employer's Agent in good time shall entitle the Employer's Agent to reclassify, at his discretion, such excavated material."

PSD 3.1.2 Classes of excavation

Notwithstanding the provisions of this subclause no distinction will be made between soft and intermediate excavation. All excavation, other than in hard rock excavation, shall for measurement and payment purposes be classified as soft excavation.

All materials encountered in any excavation for any purpose including restricted excavation will be classified as follows:

(a) Hard rock excavation

Hard rock excavation shall be excavation in material (including undecomposed boulders exceeding 0.17 cubic metres in individual volume) that cannot be efficiently removed without wedging and splitting, or hydraulic hammers.

This classification includes materials such as:

- solid unfractured rock occurring in bulk
- solid ledges thicker than 200mm
- igneous rock intrusions
- cemented sedimentary rocks.

(b) Soft excavation

Any material which can be removed by bulldozers or backhoes, shall be classified as soft excavation.

Soft excavation shall be material not falling into the category of hard rock excavation.

(c) Boulder excavation Class A

Excavation in material containing more than 40% by volume of boulders of size in the range 0.03-20 m^3, in a matrix of soft material or smaller boulders.

Excavation in dolomite formations other than solid dolomite will be classed as boulder excavation Class A if the formation contains more than 40% by volume of lumps of hard dolomite of size in the range 0.03-20 m^3, in a matrix of soft material or smaller lumps of hard dolomite.

Excavation of solid boulders or lumps of size exceeding 20 m^3 will be classed as hard rock excavation.

Excavation of fissured or fractured rock will not be classed as boulder excavation but as hard rock or intermediate excavation according to the nature of the material.

(c) Boulder excavation Class B

Boulder excavation Class B shall be excavation of boulders only, which

1) are in material containing 40% or less by volume of boulders of size in the range 0.03-20 m^3, in a matrix of soft material or smaller boulders, and which

2) require individual drilling in order to be loaded by a track type front-ended loader or back-acting excavator, as the case may be, as specified in (a)(1)or (a)(2) above.

The excavation, of the rest of the material will be classed as soft or intermediate excavation, according to the nature of the material.

PSD 3.2.3 Material Suitable for Backfill or Fill against Structures

Replace the contents of this sub-clause with the following:

"Material used for backfill behind structures shall generally be the material excavated, subject to the following conditions:

(a) The material shall not contain an excessive number of stones retained on a 50 mm sieve; and

(b) The material shall not contain large clay lumps that do not break up under the action of the compaction equipment; and

(c) The liquid limit of the material shall not exceed 40, neither shall the PI exceed 18.

(d) The minimum compaction shall be 93% of modified AASHTO maximum density."

PSD 3.3 SELECTION

PSD 3.3.1 General

Replace the second paragraph with the following:

"The Contractor shall deal selectively with materials from all excavations to ensure that no acceptable backfill or bedding material is contaminated by material unfit for use. No additional payment shall be made in this regard and all costs related to the above selection process shall be included in the applicable payment items. Should useful material be contaminated to such an extent that it is regarded as unfit for use the Contractor shall at his own cost dispose of this material and replace it with material of an equivalent standard to the acceptable in situ material."

PSD 3.3.2 Backfilling and embankments

With reference to the last line of this subclause the material to be used for backfill shall be either 15MPa/19 concrete or material complying with 3.2.2 compacted in 150mm layers to 90% of modified AASHTO maximum density, as ordered on site.

ADD THE FOLLOWING NEW CLAUSE:

"PSD 3.3.3 Selection in borrow pits and excavations
Approval of a borrow area for a certain purpose does not necessarily mean that all the material in that area is suitable for the specified purpose. What it does mean is that the borrow area contains some suitable material. The onus shall rest on the Contractor to ensure that only material that is indeed suitable is removed and used for the specified purpose.

When the Contractor has to select excavated material for a specific purpose, the above provisions relating to borrow areas shall apply mutatis mutandis to excavations.

The Contractor shall not waste or contaminate material that has been selected for a specific purpose."

PSD 4 PLANT

PSD 4.4 DETECTORS

Replace the contents of Clause 4.4 with the following:

“The Contractor shall, for the purposes of detecting and locating underground services in

accordance with the provisions of Subclause 5.4 of SANS 1200 A and Subclause 5.1.2 of SANS 1200 D, at its own cost, provide and use detecting equipment which is suitable for the detection of underground cables and pipes."

PSD 4.2 COMPACTION

Where it is required that the work be carried out using labour intensive methods, the Contractor shall not use compaction plant larger than a walk-behind compactor.

PSD 5 CONSTRUCTION

PSD 5.1 PRECAUTIONS

PSD 5.1.1 Safety

PSD 5.1.1.1 Barricading and lighting

Replace "Machinery and Occupational Safety Act, 1983 (Act 6 of 1983)" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Construction Regulations 2014".

ADD THE FOLLOWING WORDING:

"Without limiting any obligation which the Contractor may have in terms of any Act, Ordinance or other legislation, the Contractor shall ensure that all excavations which are accessible to the public or which are adjacent to a public road or thoroughfare, or by which the safety of persons may be endangered are protected as set out in Clause 13 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 and that Watchmen are employed to ensure that barricades, barriers and lights are effective at all times.

Trench excavations shall be protected by means of at least two horizontal wires with double sided red/white; chevron tape wrapped over the wires as approved by the Employer's Agent. The wires shall be stretched tightly between supports along both sides and ends of the excavation at levels approximately 0,45m and 1,12m above the ground. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 10m centres so as to enclose the spoil and the excavations.

Bridges for vehicles and/or pedestrians shall be provided along the route of the work as and where may be considered necessary by the Employer's Agent. They shall consist of a number of suitably sized steel plates laid across open excavated trenches. They shall be protected on each side by steel handrails, at least 1m high, securely fastened to the steel plates. At least 4 lamps or reflective markers must be provided at each crossing.

Where construction is in, or across, public roads the barricades or barriers and temporary road signs shall be erected. All such signs and positioning thereof shall comply with the requirements set out in Road Note 13 read in conjunction with the SA Road Traffic Signs Manual."

PSD 5.1.1.2 Safeguarding of excavations

Replace "Machinery and Occupational Safety Act" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Construction Regulations 2014".

Add the following to paragraph (b) (1):

"Payment for supporting the sides of excavations and trenches shall be deemed to be included in the rates tendered for excavations. No separate payment will be made in this regard and it will be the Contractor's

responsibility to ensure the safety and stability of all excavations.

Where trenches have to be widened to accommodate manholes, junction boxes, etc., the cost of supporting the vertical sides of such additional excavations will be deemed to be included in the rates tendered for excavation."

Add the following to paragraph (b) (2):

"The slope of the sides of an excavation or trench may never be steeper than 60° to the horizontal and all costs incurred to slope the sides of an excavation or trench will, irrespective of the angle of the slope, be deemed to be included in the rates quoted for excavation."

PSD 5.1.1.3 Explosives

Replace the contents of this Clause with the following:

“No overbreak allowance shall apply to this Contract.

The Contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures, and for other purposes where explosives are normally required, subject to the following conditions:

(a) The Employer’s Agent may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Employer’s Agent shall not entitle the Contractor to additional payment for having to resort to less economical methods of construction.

(b) The Employer’s Agent's prior written approval shall be obtained for each and every blasting operation. Such approval may not be withheld where the Contractor use explosives responsibly and carefully.

(c) The Contractor shall fully comply with the requirements of the Explosives Act, Act 83 of 1997 and all other legislation and regulations as may be applicable to blasting and the use of explosives.

(d) Before any blasting is undertaken, the Contractor shall satisfy the Employer’s Agent that he has established whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting area. Should such inspections be required, the Contractor shall, together with the Employer’s Agent and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before the commencement of blasting operations.

(e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (e.g. cover-blasting, to reduce the risk of damage).

(f) All accidents, injury to persons and animals and damage to property shall be reported to the Employer's Agent, in detail and in writing, as soon as is practicable.

(g) The Employer's Agent shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.

(h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at its own expense, any additional excavation necessitated by the shattering of rock in excess of any overbreak allowances specified in the Project Specifications or given on any drawing.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations."

PSD 5.1.2 Existing services

PSD 5.1.2.2 Detection, location and exposure

Replace the contents of Clause 5.1.2.2 with the following:

"The exposure by the Contractor of underground services, as required in terms of Clause 5.4 of SANS 1200 A and PSA 5.4 shall be carried out by careful hand excavation at such positions and to such dimensions as are agreed to by the Employer's Agent.

Unless otherwise instructed or agreed by the Employer's Agent, no service shall be left exposed after its exact position has been determined and all excavations carried out for the purposes of exposing underground services shall be promptly backfilled and compacted to the following densities:

(a) In roadways: 95% Mod AASHTO density; and
(b) In all other areas: 93% Mod AASHTO density.

Where hand excavations to expose underground services have to be carried out in roadways, the Contractor shall reinstate the road layerworks in accordance with the provisions of the Contract or as directed.

Payment in respect of the exposing of the services by means of hand excavation as described above shall be deemed to be covered by the rates tendered under items PSA 8.8.4(c)."
Payment in respect of the reinstatement of layerworks in road ways will be made in accordance with PSDB 8.3.6.1 and subclause 8.3.6.1 of SANS 1200 DB."

PSD 5.1.2.3 Protection of cables

Replace Clause 5.1.2.3 with the following:

"5.1.2.3 Protection during Construction

Further to the requirements of PSA 5.4.2 and Subclause 5.4.2 of SANS 1200 A, major excavating equipment and other Plant shall not be operated dangerously close to Known Services. Where

necessary, excavation in close proximity to Known Services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Should any service not being a Known Service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of Sub-clause 5.4.2 of SANS 1200 A (as amended), immediately notify the Employer's Agent thereof and implement such measures as will prevent damage of such service or, if it was damaged in the course of discovery, will prevent and minimise the occurrence of any further damage occurring."

PSD 5.1.2.4 Negligence

The Contractor shall not repair any service damaged. Where the damage is the result of the Contractor's negligence he shall bear all costs of the repairs undertaken by the owner, as well as the costs of associated damages."

DELETE SUBSUBCLAUSE 5.1.2.4

PSD 5.1.5 Reinstatement and maintenance of roads

ADD THE FOLLOWING:

"Where crossings have been made, the roads shall be reinstated in accordance with the details specified in subclause 5.9 of SANS 1200 DB."

PSD 5.1.6 Road traffic control

Delete the contents of Clause 5.1.6 and replace with the following:
"The provisions of PSA 5.10 shall apply as applicable. Where the work affects the operation or safety of public road traffic, vehicular and/or pedestrians in addition, to complying with the requirements of 5.1.1.1, the Contractor shall provide, erect and maintain traffic signs, personnel and equipment that conform to the requirements, layout and guidelines of the "South African Road Traffic Signs Manual", as well as the Site Manual entitled "Safety at Roadworks in Urban Areas" as published by the Department of Transport, in number and in layout, as shown in these manuals.

Where necessary and as shown in these manuals, warning lights, an adequate number of flagmen and appropriate barricades, clearly visible to oncoming traffic at all times of the day and night shall be provided. If steel drums are used for this purpose, they shall be ballasted with soil, sand or stones and the outside shall be whitewashed and provided with retro-reflective material (in the case of tape, of minimum width 10mm), red on the left-hand side facing oncoming traffic and white on the right-hand side. The drums shall be maintained in a clean and effective condition and no stones shall be placed on them.

No direct payment will be made for the cost of providing and complying to the aforementioned. Payment will be deemed to be covered by the rates and sums tendered and paid for the various items of work included under the Contract."

PSD 5.2 METHODS AND PROCEDURES

PSD 5.2.1 Site preparation

PSD 5.2.1.2 Conservation of topsoil

Add the following:

“Topsoil ordered to be stripped and conserved for later use shall be stockpiled in a manageable heap where designated by the Employer’s Agent. The material together with such vegetation and small roots as may occur within the specified depth shall be stripped, loaded, transported to stockpile within a freehaul distance of 0,5 km, maintained and wetted (dust control) for the full duration of the Contract or until use.”

PSD 5.2.2 Excavation

PSD 5.2.2.1 Excavation for General Earthworks and for Structures

Add the following to paragraph (b):

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. In general, payment will be made for excavating a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."
Replace the first sentence of paragraph (e) with the following*:*

"Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel material compacted to 98% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.

Where excavations for structures have been carried out in hard material, the Employer’s Agent may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall retrim the excavations if necessary and, unless other remedial measures are agreed to by the Employer’s Agent, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

PSD 5.2.2.3 Disposal

Replace the second sentence with the following:

“The Contractor shall, provide all necessary spoil sites for the spoiling of all surplus and unsuitable materials and shall make the necessary arrangements with the owner of the site where the material is disposed of, and pay all charges and levies as may be applicable for the use of such spoil sites.

Every spoil site provided by the Contractor shall be approved by the local authority in whose area it is located, and the spoiling shall comply with the applicable statutory and municipal regulations as well as the requirements of the owner of the spoil site.

Payment to the Contractor in respect of locating and making arrangements for suitable spoil sites and spoiling material at the such sites will be made in accordance with the provisions of Sub-clause PSD 8.3.15."

"PSD 5.2.2.4* Selection and Stockpiling

Approval or designation of the material in a particular borrow pit or excavation for a particular purpose does not imply that all the material in the borrow pit or excavation is suitable for the particular purpose for which the said approval or designation relates, nor that all material in the borrow pit or excavation should be used for the particular purpose. The Contractor shall select suitable material from that borrow pit or excavation, discard unsuitable material and reserve material for other purposes as necessary.

The Contractor shall organise and carry out its operations in such a manner as will prevent the contamination of suitable embankment, fill and backfill material with unsuitable materials. Any excavated material which becomes, in the Employer's Agent opinion, unsuitable for use in embankments, fills or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Employer's Agent and shall be replaced by the Contractor with materials acceptable to the Employer's Agent, all at the Contractor's cost.

When required, or when ordered by the Employer's Agent, material shall be temporary stockpiled at sites indicated by the Employer's Agent for later use. The additional costs of stockpiling material shall be paid to the Contractor in accordance with the provisions of Sub-clause PSD 8.3.14."
PSD 5.2.2.5* Excavation of hard rock without blasting

Due to the fact that construction of the pipeline may be alongside existing services, pipelines and in certain areas are near structures/buildings, the Contractor shall exert maximum caution in his methods and

operations. In such cases, and where instructed by the Employer's Agent, the Contactor shall use non-explosive methods approved by the Employer's Agent. These methods include hand pneumatic hammers,

excavator mounted hydraulic hammers (breakers), expansive chemical products, or other method approved by the Employer's Agent.

The application of this Subclause will not relieve the Contractor of his responsibilities in accordance with Subclause 5.1.1.3 or otherwise in terms of the Contract.

PSD 5.2.2.6 Recording of original ground profiles

The Contractor shall inform the Employer's Agent, in writing, at least 28 days before commencing any work which will result in a change in the topography of the site, whether such work be for the permanent works or for temporary works which the Contractor intends to execute for his own convenience. Thereupon, before commencing the work, the Contractor shall undertake cross-sections of the original ground profiles at structures and a centreline survey of the pipeline or another approved method to determine the ground profiles of the entire area to be worked. In addition, all rock and/or foundation levels shall be recorded as the work proceeds.

The information so obtained shall be permanently recorded on a drawing or drawings which shall each be signed by both the Contractor and the Employer's Agent. The Contractor shall then provide the Employer's Agent with a reproducible copy of each drawing to serve as a permanent record both for the purpose of redesign of pipeline vertical alignment, determining the quantities of excavation and earthworks carried out in the construction of the permanent works and the extent to which temporary works shall be removed or temporary excavations shall be refilled upon completion of the Works."

PSD 5.2.3 Placing and Compaction

PSD 5.2.3.1 Embankments

Replace the first sentence of the sixth paragraph with the following:

"Each layer shall be compacted at OMC to a density as specified and in the case of cohesive soil and 100% of modified AASHTO maximum density in the case of non-cohesive soil."

PSD 5.2.3.3* The material of each area of fill shall, unless otherwise approved, be deposited in layers of thickness, before compaction, not exceeding 150 mm. The material shall be spread to form a layer that is approximately uniform thickness and graded over the whole area of the fill site.

Each layer shall be compacted at OMC to a density of at least 93% of modified AASHTO density in the case of cohesive soil or 100% in the case of non-cohesive soil. Should the material be too wet, owing to rain or any other cause, it shall be harrowed and allowed to dry out to the correct moisture content before compaction is undertaken.

The contractor shall ensure that stormwater will at all times be discharged uniformly over the full fill area or through specially prepared and protected drainage ditches to prevent scouring of the slopes."

"PSD 5.2.3.4 Backfilling over-excavation and overbreak

The material to be used shall comply with 3.2.1, except that the maximum particle size shall not exceed $^{2}/_{3}$ of the thickness of the layer being placed and shall be compacted to at least 93% of modified AASHTO maximum density.

PSD 5.2.4.2 Finishing

a) Topsoiling

IN SUBCLAUSE 5.2.4.2, REPLACE THE WORDING "75 mm" IN THE LAST SENTENCE WITH: "100 mm"

PSD 5.2.4.3 Grass or other vegetation

ADD THE FOLLOWING:

"(a) Fertiliser/soil improvement material

The fertilisers for areas to be hydro-seeded are as follows:

i) Superphosphate – 150 kg/ha
ii) 2 : 3 : 2 (22) – 200kg/ha"

(b) Grass seeds

Only fresh certified seed shall be used, and the seed mixture shall be as follows:

Mix A – (Winter – April to June)

Westerworld ryegrass (var Midmar)	:	20 kg/ha
Cynodon Dactylon	:	20 kg/ha
Eragrosis Curvula	:	20 kg/ha
Eragrosis Tef	:	20 kg/ha

Mix B – (Summer – July to September)
As for Mix A, except that Westerworld ryegrass is substituted with Italian ryegrass (var. Turtetra)."

(c) Anti-erosion compounds

"Anti-erosion compound shall be Verdyol Complex (or similar) applied at a rate of 100kg/ha."

PSD 5.2.6.2 Grassing

(a) Hydroseeding

Mulch shall be added to the hydro-seeding mix at a rate of 2000kg/ha.

PSD 5.2.6.3 Planting and maintaining the plants

(a) Watering, weeding, mowing and replanting

The mowing of grass to control weeds shall not be measured and paid for.

PSD 5.2.5 Transport for Earthworks

Replace the contents of Sub-clause 5.2.5 with the following:

"The transport and haul of all excavated materials, as well as material imported from commercial sources or borrow pits selected by the Contractor, irrespective of the distance and source, shall be deemed to be freehaul, the cost of which shall be included in the Contractor's tendered rates and prices for the excavation of the materials. No separate compensation shall apply for the transportation of excavated materials."

PSD 6 TOLERANCES

PSD 6.1 POSITIONS, DIMENSIONS, LEVELS, ETC.

Add the following:

"PSD 6.1(c) Bulk earthworks

The tolerances applicable to excavations for structural foundations (degree of accuracy II), as specified in Subclause 6.1(a) shall apply, provided no ponding areas or adverse grades result."

PSD 7 TESTING

PSD 7.2 TAKING AND TESTING OF SAMPLES

Replace the contents of this subclause with the following:

"The Contractor shall arrange with the approved independent laboratory engaged by the Contractor in terms of clause C3.4.9 of the Scope of Works, to carry out sufficient tests on a regular basis as agreed between it and the Employer's Agent to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Employer's Agent in a form approved by him.

The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five percentage points below the specified value."

PSD 8 MEASUREMENT AND PAYMENT

PSD 8.3 SCHEDULED ITEMS

PSD 8.3.1 Site Preparation

Replace Clauses 8.3.1.1 and 8.3.1.2 with the following:
"Where Site preparation such as clearing, grubbing, the removal of large trees or the removal and stockpiling of topsoil or surface obstructions are required, the provisions and scheduled items of SANS 1200 C shall apply."

PSD 8.3.2 Bulk Excavation

REPLACE THE CONTENTS OF ITEM WITH THE FOLLOWING:

"(a) Excavate in all materials and use for embankment or backfill as ordered, from:

(1) Necessary excavations Unit: m^3

(2) Designated borrow pits Unit: m^3

(3) Commercial sources Unit: m^3

The unit of measurement shall be the cubic metre measured in place in accordance with subclause 8.2 of SANS 1200 D.

Separate items will be scheduled for embankments and backfills for different parts of the works.

The tendered rates shall cover the cost of complying with all the precautions required in terms of subclause 5.1 of SANS 1200 D (as amended), in addition to the cost of excavating in all materials, basic selecting, loading, transporting, off-loading, spreading or backfilling, watering, compacting, final grading, complying with the requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications.

In addition to the foregoing, the tendered rate for subitem (b) shall further include for the costs of royalties (if applicable), whilst the tendered rate for subitem (c) shall also include for the costs of finding a source of suitable

material, for making arrangements with the owner of the source, for procuring the material, for the payment of all requisite royalties, charges or damages, and for transporting the material to the site regardless of the distance involved. No payment will be made for the removal of overburden or stockpiling at the commercial source and no extra over payment shall apply for excavating in intermediate, hard or boulder material."

(b) Excavate in all materials and dispose Unit: m^3

The unit of measurement shall be the cubic metre of material excavated, measured in place in accordance with subclause 8.2 of SANS 1200 D.

The tendered rates shall cover the cost of complying with all the precautions required in terms of subclause 5.1 of SANS 1200 D (as amended), in addition to the cost of excavating, basic selecting, loading, transporting, off-loading at the spoil site, maintaining and finishing the spoil site, all in accordance with the specifications.

(c) Extra over subitems PSD 8.3.2(a)(1), PSD 8.3.2(a)(2) and PSD 8.3.2(b) for:

(2) Hard rock excavation Unit: m^3
(3) Boulder excavation, Class A Unit: m^3
(4) Boulder excavation, Class B Unit: m^3

The rate shall cover the additional cost of the operations enumerated in subclauses 8.3.2.(a) and 8.3.2.(b) above for any portion of the excavation that is classified as hard rock, boulder excavation class A or boulder excavation class B as applicable. (See Drawing D-2.)"

PSD 8.3.3 Restricted excavation

Replace the heading of subclause 8.3.3 (a) and the contents of the first two paragraphs with the following:

"PSD 8.3.3(a) Excavate for restricted foundations, footings, trenches, stormwater drains outside road reserve, open drains and cut-off drains, in all materials, and use for fill or backfill or berm or dispose, as ordered .....
Unit: m^3

Separate items will be scheduled for each category of excavation and for each class or manner of disposal of excavated material.

All restricted excavation shall be measured by volume.

Replace "in 5.2.2.1 – 5.2.2.3 (inclusive)" at the end of subclause (a) with "in Clauses 5.2.2.1 to 5.2.2.4 (inclusive)."

Delete Clause 8.3.3(b) (1) as well as any reference to intermediate excavation in subclause (b). For the purposes of measurement and payment, excavation other than hard rock and boulder excavation will not be separately classified (refer PSD 3.1.2)."

PSD 8.3.4 Importing of Materials

Delete Clause 8.3.4(a) in totality.

PSD 8.3.6 Overhaul

Delete Sub-clause 8.3.6.

No overhaul will be paid on material for the purposes of this Contract and all costs for transporting material shall be included in the applicable tendered rates and amounts.

PSD 8.3.10 Topsoiling

CHANGE THE UNIT TO "m³" AND REPLACE THE CONTENTS OF THIS ITEM WITH THE FOLLOWING:

"The unit of measurement shall be the cubic metre and the quantity shall be calculated from the authorised dimensions.
The tendered rate shall include loading of the topsoil from stockpiles, transporting it irrespective of the distance, and off-loading, spreading, shaping and lightly compacting the topsoil."

PSD 8.3.11 Grassing or other Vegetation Cover
ADD THE FOLLOWING AFTER THE SECOND SENTENCE:

"The tendered rate shall be irrespective of the number of applications required to obtain the required spread rate."

PSD 8.3.12 Road traffic signs and markings

Delete the contents of this Sub-Clause.

The provisions of PSA 5.10 shall apply.

"PSD 8.3.14* Extra over items 8.3.2.1 and PSD 8.3.3 for temporary stockpiling ..... Unit: m^3

The unit of measurement shall be the cubic metre of material from necessary excavations, temporarily stockpiled by the Contractor on the instructions of the Employer's Agent, before being used in embankments, fills or backfill.

Measurements shall be taken in place in compacted embankment, fills or backfill as the case may be.

The tendered rate shall include for the costs, additional to those provided for in PSD 8.3.2.1 and PSD 8.3.3 of off-loading, forming and maintaining the stockpile for as long as is required, reloading and transporting regardless of the distance involved from the stockpile.

Payments to the Contractor under this item will only be made in respect of that material stockpiled on the instructions of the Employer's Agent (which instruction shall state specifically that payments for such stockpiling will be paid for under this item) and no payments will be made to the Contractor under this item in respect of materials stockpiled by the Contractor on its own volition, nor for

materials necessarily stockpiled by the Contractor in consequence of the sequence of operations adopted by it in the course of executing the Works, whether such stockpiling was avoidable or otherwise."

"PSD 8.3.15* Extra over items PSD 8.3.2 and PSD 8.3.3 for disposing of spoil material on a site provided by the Contractor ..... Unit: m³

The unit of measurement shall be the cubic metre, measured in accordance with Sub-clause 8.2 of SANS 1200 D, of surplus and/or unsuitable material disposed of, on the instruction of the Employer's Agent, at a spoil site or spoil sites provided by the Contractor.

The tendered rate shall include full compensation for the additional cost of providing a spoil site or other means of disposing of surplus spoil material, for transporting the material regardless of the distance involved, for acceptance charges for such material and for all other incidental costs to dispose of the spoil material."

"PSD 8.3.16* Extra and dispose of unsuitable material from sides or bottom of restricted foundations, footings, trenches and stormwater drains where ordered and replace with:

(a) Selected material complying with subclause 3.2.2 of SANS 1200 ME compacted to 90% of modified AASHTO maximum density ..... Unit: m³

(b) 15MPa/19 concrete ..... Unit: m³

Separate items will be scheduled for each type of excavation, source of backfill material and manner of backfill.

The rates tendered shall cover the cost of excavating the unsuitable material to the extent ordered by the Employer's Agent, disposing of the material at a spoil site provided by the Contractor and subsequent backfilling of the excavation using selected material or concrete as ordered.

NOTE:

The work required to construct the selected layer beneath areas to be concrete lined will be measured for payment under (a) as applicable. The unit of measurement shall be the cubic metre of selected material placed and compacted. Any excavation required to accommodate the concrete lining will be deemed to be covered by subclause 8.3.4 of SANS 1200 DM."

PSDB EARTHWORKS (PIPE TRENCHES)

PSDB 3 MATERIALS

PSDB 3.1 CLASSES OF EXCAVATION

Delete the contents of Clause 3.1 and replace with the following:

"The classification shall be as described in PSD 3.1".

PSDB 3.5 BACKFILL MATERIAL

Delete the contents of Clause 3.5(b) and replace with the following:

“In areas subject to road traffic loads which shall be held to extend 1000mm beyond the edge of the roadway, backfill shall comprise of material having a PI = 10 and a CBR at the specified density ≥ 45 compacted in 150mm layers to 95% of modified AASHTO maximum density.”

Add the following paragraphs to sub-clause 3.5:

"(c) Cement-stabilised backfilling

Backfilling shall, where directed by the Employer’s Agent, be stabilised with 5% cement. The aggregate shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The soil or gravel shall be mixed with 5% cement and shall be compacted in layers of 100 mm thick to 90% of modified AASHTO density.

(d) Soilcrete backfilling

The aggregate for soilcrete shall be mixed with 5% cement and shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The soil or gravel shall be mixed in a concrete mixer with the cement and enough water to acquire a consistency that allows the mixture to be placed with vibrators to fill all voids between the pipe and the sides of the trench. Shuttering shall be used where necessary."

PSDB 3.7 SELECTION

Replace the words “if he so wishes” in the first line of the second paragraph with the words “at his own cost”.

REPLACE THE SECOND AND THIRD SENTENCES OF SUBCLAUSE 3.7 WITH THE FOLLOWING:

“The Contractor is required to use selective methods of excavation. The Contractor shall selectively remove and keep separate the sandy materials from unsuitable material and place it adjacent to the trench for reuse as backfill, selected fill, selected granular material, selected rockfill or for other use as ordered by the Employer’s Agent.”

ADD THE FOLLOWING AT THE END OF SUBCLAUSE 3.7:

“Material which, in terms of Subclause 6.2 of SANS 1200 D or Subclause 6.1 of SANS 1200 LB, is too wet for immediate use in the trench (but which is otherwise suitable) will not be regarded as “unsuitable” material and, if so ordered by the Employer’s Agent, the Contractor shall spread such material in a suitable area until it has dried sufficient for later use. Should the material which is replaced in the trench become too wet again, due to the fact that the Contractor made insufficient provision for the handling and removal of

groundwater in accordance with Subclause 5.5 of SANS 1200 A, the Contractor shall replace the material at his own cost with material which is, in the opinion of the Employer’s Agent, suitable.

When preparing his programme and construction methods, the Contractor shall make allowance for selective excavation and the handling and drying out of materials which is too wet for immediate use."

PSDB 4 PLANT

PSDB 4.1 Excavation equipment

Where it is required that the work is to be carried out using labour intensive methods, 4.1 shall read:

"Except that the Contractor may use the tools, equipment and plant specified for the classification of the material in the excavation of that material, the Contractor shall use only hand tools such as picks, shovels and sledgehammers".

PSDB 4.3 Compaction equipment

Where it is required that the work is to be carried out using labour intensive methods, 4.3 shall read:

"The Contractor shall use only hand tampers and hand-held pneumatic tampers to compact the material in the trench. He shall carry out his compaction in such a manner that the pipeline, duct or cable is not stressed or damaged. The material directly above the pipe, duct or cable shall not be compacted until sufficient backfill has been placed to ensure the loads transmitted to the top of the pipe, etc. are no greater than would be imposed by normal road traffic over a pipeline with cover of depth 600 mm".

PSDB 5 CONSTRUCTION

PSDB 5.1.2.2 Special water hazards
The Contractor shall take note that no special water hazards are designated. The Contractor shall therefore deal with all water as specified in 5.1.2.1, including flow into trenches due to a high or perched water table and any overland flow.

PSDB 5.1 PRECAUTIONS

PSDB 5.1.3 a) Sloping ground

DELETE THE SUBCLAUSE AND SUBSTITUTE WITH THE FOLLOWING:

"The Contractor shall be responsible throughout the duration of the Contract, inclusive of the Defects Liability Period, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipeline(s) and land utilised by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Cross embankments, generally extending across the full width of the working strip, consisting of low earth mounds shaped to rounded form and so oriented as to have a fall of 1% along their length, shall be constructed with compacted material having a minimum density of 90% modified AASHTO density and

minimum dimensions and maximum spacings dependent on the slope of the ground along the length of the pipeline, as indicated on the drawings.

Cross-embankments shall be constructed to the same minimum standards and dimensions indicated above wherever artificial slopes have been formed on the working strip or other areas used during construction and, with the approval of the Employer's Agent, are permitted to be so left.

Payment will be made for the construction of cross-embankments provided construction thereof has been either ordered or approved by the Employer's Agent prior to the commencement of such construction."

b) New Subclause under Subclause 5.1.2

ADD THE FOLLOWING NEW SUBCLAUSE TO SUBCLAUSE 5.1.2:

"5.1.2.4 Cross-walls in trenches.
In steeply sloping trenches at between 15 and 20% grade, or where erosion becomes evident on site, or where ordered by the Employer's Agent, the Contractor shall place sacks of earth as cross walls around and above the pipe up to ground level, prior to backfilling, as a soil erosion measure as indicated on the drawings.

Where required, an item will be included in the Bill of Quantities to cover the cost of the supply, installation and maintenance of sack breakers.

5.1.2.5 Concrete anchor blocks where gradient equals or exceeds 20%.
Where the grade of the pipe equals or exceeds 20% the Contractor shall provide concrete anchor blocks.

Where required, an item will be included in the Bill of Quantities to cover the cost of the supply, installation and maintenance of concrete anchor blocks, including the wrapping of the encased pipe portion with an approved tape wrapping such as Denso Ultraflex or similar approved."

c) Accommodation of traffic and access to properties

REPLACE THE SEMICOLON AND THE WORD "and" AT THE END OF SUBCLAUSE 5.1.3(a) WITH A FULL STOP AND REPLACE ITEM (b) WITH THE FOLLOWING:

"(b) Where necessary to achieve compliance by the Contractor with his obligations in terms of subclause C3.4.2.5(e) Scope of Works to provide and maintain pedestrian and vehicular access to properties affected by the works, the Contractor shall construct and maintain to the satisfaction of the Employer's Agent, such temporary access roads around, and/or steel or timber bridges over excavations in roads, pavements, entrances or accesses to properties.

Temporary pedestrian access bridges shall be at least 1,2 m wide and temporary access bridges for vehicles shall be at least 3,6 m wide. All temporary access bridges shall be fitted with handrails as well as protective mesh fencing on both sides.

On completion of the work, the Contractor shall dismantle and remove all such temporary constructions and reinstate these areas to their former condition.

Except only where the Employer's Agent has included in the Schedule of Quantities, particular payment items specifically therefor, the Contractor will not be paid directly for the construction and maintenance of temporary access roads and/or the provision and maintenance of bridges as aforementioned, and the costs thereof shall be deemed included in the Contractor's tendered rates for excavation."

ADD THE FOLLOWING NEW SUBCLAUSE TO SUBCLAUSE 5.1:

"PSDB 5.1.5 Removal of existing pipelines

Where existing pipes have to be removed, they shall be carefully opened up by machine excavation to 300 mm above the pipes after which the whole pipe shall be fully exposed by means of hand excavation. The excavation width shall comply with subclause 8.2.3.

The pipes shall be removed from the trench in a manner approved by the Employer's Agent and brought to the surface for inspection by the Employer's Agent.
Pipes that are declared suitable for reuse and pipes declared unfit for reuse shall be dealt with in an applicable manner described in the specifications, or on the Drawings or on the Employer's Agent's instructions, as relevant.

"PSDB 5.2 MINIMUM BASE WIDTHS

REPLACE PARAGRAPH (a) WITH THE FOLLOWING:

"Where two pipes are placed in the same trench, they shall be 300 mm apart and the specified side allowance shall still be applicable."

ADD THE FOLLOWING AFTER PARAGRAPH (b):

"The above is not applicable to trenches for subsurface drains.

Trenches for subsurface drains shall be excavated to the dimensions and gradients shown on the Drawings or directed by the Employer's Agent.

The specified width of trenches and the width of the excavation measured for payment shall not be less than 0,5 m, but the Contractor may reduce the actual width with the Employer's Agent's permission."

PSDB 5.4 EXCAVATION

Add the following:

"Except where otherwise specified, trenches shall be of such a depth that the minimum cover over the pipes shall be 900 mm, except at road-crossings, where the minimum cover shall be 1000 mm .

No trench may be left open over the period 16 December to 8 January inclusive.

In the open veld the Contractor shall limit the length of trenches open, at any time, to a maximum of 300 m per pipelaying team or between fence crossings, whichever is the shorter. Similarly, the maximum length of open trenches within the villages shall be 100m.

Where trenches have to be excavated under this Contract adjacent to live services / other services laid under other contracts, it may be necessary to shore trenches to prevent damage to the live services / other services. It will be the responsibility of the Contractor to ensure that services constructed under other contracts of live services are not damaged by his operations during the Contract."

Should the Contractor detect areas where the cover is doubtful, he shall report this immediately in writing to the Employer's Agent, before any pipes are laid, so that remedial steps can be taken.

The Contractor shall exert maximum caution in excavating alongside or near existing services, pipelines, buildings or structures. The Contractor shall use non-explosive methods for the excavation of hard rock in these cases and where instructed by the Employer's Agent (see 5.2.2.5)."

PSDB 5.6 BACKFILL

PSDB 5.6.1 General

Replace the first sentence with the following:

"Backfilling of pipe trenches may only commence after the pipe has been laid, firmly bedded in the specified cradle, the blanket placed and compacted as specified and after the pipe has been tested in terms of Clause 7 of SANS 1200 L."

PSDB 5.6.2 Material for backfilling

Replace the last paragraph of this Clause "In areas……backfill" with the following:

"The material for backfilling in areas subject to road traffic loads shall comply with PSDB 3.5."

PSDB 5.6.3 Disposal of soft excavation material

Replace the words "unless otherwise required in the project specification." at the end of this Subclause with:

"or to spoil in accordance with the requirements of PSD 5.2.2.3 and Subclause 5.2.2.3 of SANS 1200 D, as instructed by the Employer's Agent."

PSDB 5.6.4 Disposal of intermediate and hard rock material

REPLACE THE LAST SECTION OF SUBCLAUSE 5.6.4 ".... disposed of as specified in 5.6.3 or removed to designated sites," WITH ".... disposed of outside the site boundaries."

PSDB 5.6.6 Completion of backfilling

Add the following:

“If in the opinion of the Employer’s Agent insufficient progress is being made with the backfilling of trenches, the Employer’s Agent will be entitled to order than no further excavation takes place until the backfilling operation has caught up.”

ADD THE FOLLOWING:

"PSDB 5.6.9 Backfilling around structures

Backfilling around a structure shall not be commenced before it has been approved by the Employer’s Agent.

Granular material shall be used as backfill material around structures as shown on the drawings and shall be placed in layers not exceeding 150 mm compacted thickness, each layer being thoroughly compacted to 100% of modified AASHTO density as instructed by the Employer’s Agent before the succeeding layer is placed. Unsuitable or surplus excavated material shall be spoiled off site."

ADD THE FOLLOWING NEW SUBCLAUSE UNDER SUBCLAUSE 5.6:

"PSDB 5.6.10 Selection and disposal of rockfill to erosion channels.

Where directed by the Employer’s Agent, the Contractor shall select rockfill from surplus excavated material and dispose of the material at erosion channels identified by the Employer’s Agent.

Rockfill shall be comprised of 40% to 50% by volume of rocks/boulders of size in the range of 0.02–0.50 m^3, with the remaining volume made up of material of smaller particle sizes of which at least 80% passes a 6mm sieve. The rockfill shall be thoroughly mixed before disposal.

The material shall be disposed of at the identified erosion channel sites, to the dimensions and levels confirmed by the Employer’s Agent, and compacted.”

PSDB 5.7 COMPACTION

PSDB 5.7.1 Areas not subject to Traffic Loads

Add the following sentence:

"All non-cohesive material shall be compacted to 100% of modified AASHTO maximum density."

Replace the heading and contents of subclause 5.7.2 with the following:

PSDB 5.7.2 Areas Subject to Traffic Loads:

In areas subject to traffic loads, trenches shall be backfilled from the top of the bedding to the extent scheduled below in layers of thickness not exceeding 150mm after compaction, and the material shall be compacted to 95% of modified AASHTO maximum density.

TRENCH DESCRIPTION	EXTENT OF BACKFILL
Trenches beneath roadways to be constructed under the contract	Up to designated level of underside of layerworks

PSDB 5.12 UNSTABLE TRENCH BOTTOM

The Employer's Agent may, upon consideration of the condition of the trench bottom, particularly with regard to the properties of the soil materials, order the use of a crushed stone layer in order to provide a stable platform for placing of the pipe bedding and laying the pipe in certain sections of the trenches. The stone layer shall consist of 19 mm single-sized crushed stone and shall have a specified thickness of 150 mm over the specified minimum base width.

Should the material in the trench bottom or the bedding material be of such a nature that it can penetrate the stone layer, the Employer's Agent may instruct the Contractor to enclose the stone layer completely within a geotextile filter blanket which shall comply with the requirements of PSLB 3.6, and shall have overlaps of at least 200 mm.

PSDB 5.13 LENGTH OF OPEN TRENCH

No more than 300 m of trench per pipe-laying team may be open at any one time.

PSDB 5.14 DEPOSITING MATERIAL EXCAVATED FROM TRENCH

Unless otherwise ordered by the Employer's Agent, all excavated material shall be kept within 5 m of the pipeline centreline. The toe of the bank of excavated material shall be trimmed well back from the edge of the trench so as to leave a minimum 0,6 m clearance between the toe of the bank and the edge of the trench. The Contractor shall keep this strip clear of excavated material at all times.

The Contractor shall take steps to avoid burying or contaminating topsoil which shall be set aside for replacing, as far as practical, on the surface from which it was excavated.

PSDB 5.15 CLEANING UP AS WORK PROCEEDS

The Contractor shall complete all backfilling, trimming, levelling and cleaning up of the Site as work proceeds. This work shall not lag by more than 1 km behind the pipe-laying team."

PSDB 7 TESTING

The Contractor shall carry out density tests as specified in TMH1, in the positions indicated by the Employer's Agent, to determine the compaction of the backfill material in the trenches and the material used for reinstating the road construction layers. No single test result which is below the specified density, will be accepted.

In the case of trenches in areas subject to traffic loads, the Contractor shall, notwithstanding the terms of the second sentence of Subclause 7.1, bear the cost of all density tests carried out except as follows. Where the test results are equal to or exceed the specified density, the Employer will bear the cost of that number

of those tests ordered by the Employer's Agent in excess of one test per 20 m^3 of compacted material, based on the total volume of backfill and reinstated road layers, including the replacement of any over-excavation, in areas subject to traffic loads.

The Contractor shall also bear the cost of those density tests, carried out by the Employer's Agent, of which the test results are below the specified density.

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.1 BASIC PRINCIPLES

PSDB 8.1.1 Replace "along the route of the pipeline" in the third line of Clause 8.1.1 with "as specified in PSDB 5.6.3".

PSDB 8.1.2 ADD THE FOLLOWING:

"In the road prism or building platform the ground surface from which depth will be measured will always (irrespective of operation sequenced) be the road bed level at centre-line."
PSDB 8.2.3 REPLACE THE CONTENTS OF SUBCLAUSE 8.2.3 WITH THE FOLLOWING:

"Wherever volumetric measurement is required, the volume will be computed according to the depths indicated on the drawings, or to the bottom of the specified bedding cradle, whichever is the greater, and the width determined from the applicable side allowance (see drawing 1005270-0000-DRG-CC-603) plus the nominal width of the pipe. Side allowance shall be measured from the outside of the pipe. No allowance shall be made for the extra thickness of the collars or couplings.

The side allowance for ducts shall be 150 mm and there shall be 300 mm between a Telkom duct and any other duct/service placed in the same trench.

Where two or more pipes/ducts are to be placed in one trench, the specified base width shall be calculated as follows:

The trench width for the deeper service shall be calculated according to above specifications. The effective trench width for the shallower service shall then be the difference between its specified base width and the overlap with the trench of the deeper service.

The trench width for subsurface drains shall be as shown on the drawings."

Replace the contents of subclause 8.2.4 with the following:

"No separate items will be measured for shoring. Refer to Item PSD 5.1.1.2 in this regard."

"PSDB 8.2.5* If payment in terms of PSA 8.8.4 has been made to expose an existing service and the excavation involved falls within a proposed trench, the quantity measured for trench excavation shall be reduced accordingly."

PSDB 8.3 SCHEDULED ITEMS

PSDB 8.3.2 <u>Excavation</u>

(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material .....
.....Unit: m or m³

Replace the first sentence with the following:

“Items will be provided for various trenches widths as specified and detailed on the Drawings and various depths in increments as specified in the Bill of Quantities.”

Add the following to Clause (a):

“The rate tendered shall also cover the cost of complying with PSDB 3.5, as well as the cost of any disruption or delay in complying with PSDB 5.4 and PSL 5.1.4.

ADD THE FOLLOWING AT THE END OF SUBCLAUSE 8.3.2(a):

“The Contractor will be allowed to claim the following percentages for interim payment purposes, as the following various activities are completed (Note that the percentage applicable is given as a cumulative figure):

Stage Achieved	Percentage applicable for interim payment
Material excavated	65.0%
Backfill completed and compaction successfully tested	90.0%
Surplus material removed and area finished	100.0%”

Delete Clause 8.3.2 (b)(1) as well as any reference to intermediate excavation in Clause (b). For the purpose of measurement and payment, excavation other than hard rock excavation will not be separately classified (refer PSDB 3.1).

Measurement and payment shall be in accordance with the provisions of 8.3.2(b) of SANS 1200 D (as amended)."
No payments will be made under subitems (1) and (2) in respect of any materials measured and paid for under subitem (3) below."

Add the following new sub-items in 8.3.2 (b):

“(3) Extra over 8.3.2a.and PSDB 8.3.2a for disposing of spoil material on a site provided by the Contractor .....Unit: m³

The unit of measurement shall be the cubic metre, measured in accordance with Sub-clause 8.2 of SANS 1200 D, of surplus and/or unsuitable material disposed of, on the instruction of the Employer’s Agent, at a spoil site or spoil sites provided by the Contractor.

The tendered rate shall include full compensation for the additional cost of providing a spoil site or other means of disposing of surplus spoil material, for transporting the material regardless of the distance involved, for acceptance charges for such material and for all other incidental costs to dispose of the spoil material.
(4) Backfill stabilised with 5% cement where directed by the Employer’s Agent ..... Unit : m³

The unit of measurement shall be the cubic metre of backfill material, measured in place after compaction according to the authorised dimensions, which was stabilised on the Employer's Agent instructions in accordance with Sub-clause PSDB 3.5(c).

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing, backfilling and compacting the stabilised material to 90% of modified AASHTO density."

(5) Soilcrete backfill where directed by the Employer's Agent ..... Unit : m^3

The unit of measurement shall be the cubic metre of soilcrete placed on the Employer's Agent instructions in accordance with Sub-clause PSDB 3.5(d), measured in place according to the authorised dimensions.

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing and placing the soilcrete as well as for the cost of shuttering if required."

"(6) Hand excavation where ordered by the Employer's Agent in:

i) Soft material Unit: m^3

ii) Hard material Unit: m^3

The unit of measurement shall be the cubic metre of material, measured in place according to the authorised dimensions, which was excavated by hand on the specific prior written instructions of the Employer's Agent; provided always that the Employer's Agent's said instruction shall have stated that measurement and payment for such hand excavation will be in accordance with this item.

The tendered rate shall include full compensation for the additional cost, effort and time resulting from excavating in the respective materials using hand methods only.
The Employer's Agent shall not be obliged to authorise payment under this item in respect of any hand excavation carried out (whether ordered in writing or otherwise), which hand excavation was in any case necessary to achieve compliance by the Contractor with his obligations under the Contract to

- utilise construction appropriate to the nature of the specific parts of the works; and/or
- protect existing structures and/or services; and/or
- comply with all prevailing legislation and regulations.

Add the following subclauses after subclause 8.3.2(c):

"(d) Excavate in all materials for stormwater inlet and outlet structures
and for manholes, catchpits, valve chambers and the like,
irrespective of depth, and backfill around structures: Unit: m^3

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised dimensions, and excluding the volume of material excavated and paid for under subitem (a).

The tendered rate shall include for the costs of excavating in all materials, backfilling, compacting, trimming and tidying the final surface around the structure, disposing of surplus and unsuitable

materials within the free-haul distance and, where applicable, selecting and keeping separate, excavated material suitable for use as backfill.

(e) Excavate open drains in all materials Unit: m^3

The tendered rates shall include full compensation for excavating in all materials within the dimensions specified or authorised by the Employer's Agent and to the specified lines and profiles, for the disposal of surplus and unsuitable excavated material where applicable, and in the case of item (d), for backfilling with suitable approved material compacted to 90% of modified AASHTO density around the structures.

(f) Extra over subitems (d) and (e) for excavating in:

(1) Hard rock material Unit: m^3

Measurement and payment shall be in accordance with the provisions of 8.3.2(b) of SANS 1200 D (as amended)."

PSDB 8.3.3 Excavation ancillaries

PSDB 8.3.3.3 Compaction in road reserves

REPLACE THE HEADING OF SUBCLAUSE 8.3.3.3 WITH THE FOLLOWING:

" 8.3.3.3 Compaction in road crossings"

REPLACE THE SENTENCE, "The volume will be measured as specified in 8.2.2, 8.2.3 and 8.3.3.1", WITH THE FOLLOWING:

"To determine the volume in the case of gravel roads, the depth will be measured from the underside of the gravel wearing course to the top of the fill blanket, and in the case of bitumen roads, from the underside of the subbase to the top of the fill blanket.

The rest of the trench shall be backfilled as specified in clauses 5.9.3, 5.9.4 and 5.9.5, as applicable, and payment will be made under item 8.3.6.1."

PSDB 8.3.3.4 Overhaul

Replace the contents of this subclause with the following:

"Measurement and payment shall be in accordance with subclause PSD 5.2.5."

PSDB 8.3.6 Finishing

PSDB 8.3.6.1 Reinstate road surfaces complete with all courses

ADD THE FOLLOWING:

"Where the trench crosses asphalt road surfaces, the rate shall include for neatly saw cutting the existing asphalt surfacing on all edges."

PSDB 8.3.7 Accommodation of Traffic

Delete Subclause 8.3.7. The provisions of PSA 5.10 shall apply.

ADD THE FOLLOWING ITEMS TO SUBCLAUSE 8.3:

"PSDB 8.3.8 Removal of existing pipes

(a) Excavate in all materials to 300 mm above the pipelines Unit: m³

The unit of measurement shall be the cubic metre of material excavated for the removal of pipelines in accordance with PSDB 5.11, measured in place according to the authorised dimensions. Depth shall be measured from the ground surface on the centreline of the pipeline to 300 mm above the pipe barrel.

The tendered rate shall include for excavating by any method in all materials and placing the excavated material alongside the trench.

(b) Excavate by hand to expose pipes Unit: m

The unit of measurement shall be the linear metre of pipeline finally exposed by hand excavation methods, measured in plan view along the centreline of the pipeline, irrespective of the class of pipe. Separate items will be scheduled for each different diameter of pipe. The pipe volume as well as the volume of all associated structures such as junction boxes, manholes, valve chambers and the like shall be excluded from the volume of excavation measured.

The tendered rates shall be in full and final compensation for excavating by hand methods from a depth of 300 mm above the pipe barrel in accordance with PSDB 5.11.2 to expose the pipe to its bottom, irrespective of the type or class of pipe, as well as for excavating by hand around junction boxes, manholes, valve chambers and the like.

(c) Remove pipes from trench and stack for inspection Unit: m

The unit of measurement shall be the linear metre of each type and diameter of pipe removed from the trench in accordance with subclause 5.11, measured in plan view along the centreline of the pipeline, without deduction

for specials, junction boxes, manholes, valve chambers and the like as may be encountered. Separate items shall be scheduled for each different class and diameter of pipe.

The tendered rates shall be fully inclusive for uncoupling the individual pipes and specials, all additional excavation as may be necessary to facilitate the insertion of lifting slings or the utilisation of other lifting equipment, the provision and utilisation of all such lifting equipment as may be necessary (e.g. cranes), for lifting the pipes and specials out of the trench, cleaning and stacking them along the side of the trench for inspection, attending during the Employer's Agent's inspection and recording the Employer's Agent's decisions on each pipe/special. The tendered rate shall further include for the demolition and removal from the trench of all associated pipeline structures as may be encountered, such as junction boxes, inlet and outlet structures, valve chambers, anchor blocks and the like, and the loading and removal of the debris to spoil.

(d) Deliver pipes and specials declared reusable

(i) Pipes Unit: m

The unit of measurement shall be the linear metre of pipe declared reusable by the Employer's Agent and delivered to the address specified in subclause PSDB 5.11. Separate items will be scheduled for each different type and class of pipe.

The tendered rates shall be fully inclusive for loading the pipes at the side of the trench, transporting to and off-loading at the location specified in PSDB 5.11, and carefully stacking separately according to the type, class and diameter of the pipes.

(ii) Specials Unit: number

The unit of measurement shall be the number of specials declared reusable by the Employer's Agent in accordance with subclause PSDB 5.11 above, irrespective of the type or diameter of the special, delivered to the address specified in subclause PSDB 5.11.

The tendered rate shall be fully inclusive for loading the specials at the side of the trench, transporting to and off-loading at the location specified in PSDB 5.11, and carefully stacking separately according to the type, class and diameter of the specials.

(e) Dispose of pipes and specials unsuitable for reuse

(i) Pipes Unit: m

The unit of measurement shall be the linear metre of pipe declared by the Employer's Agent to be unsuitable for reuse and disposed of by the Contractor in accordance with the requirements of PSDB 5.11.5. Separate items will be scheduled for different types and diameters of pipe.

The tendered rates shall be fully inclusive for loading the pipes at the side of the trench, transporting to and off-loading at the spoil site and dealing with them as specified in PSDB 5.11.5.

(ii) Specials Unit: number

The unit of measurement shall be the number of specials declared by the Employer's Agent to be unsuitable for reuse and disposed of by the Contractor in accordance with the requirements of PSDB 5.11.5. Separate items will be scheduled for different types of special.

The tendered rate shall include for loading the specials at the side of the trench transporting them to and off-loading them at the spoil site and dealing with them as specified in PSDB 5.11.5.

(f) Backfill and compact trench Unit: m^3

The unit of measurement shall be the cubic metre of compacted fill, measured tight according to the authorised dimensions of the trench.

The tendered rate shall be fully inclusive for placing excavated material in the trench and compacting in accordance with subclauses SANS 1200 DB 5.6 and 5.7 (as amended).

(g) Make up deficiency in backfill material Unit: m³

The unit of measurement shall be the cubic metre of backfill obtained from sources other than the trench excavated for the purposes of removing the pipeline in order to make up any deficiencies in backfill material resulting from the volume previously occupied by the pipeline.

Except that the volume shall be determined as the external volume of the pipes removed together with the external volume of all ancillary structures removed along the pipeline, measurement and payment shall be in accordance with 8.3.3.1 of SANS 1200 DB.

PSDB 8.3.9 Provision of temporary bridges for maintaining access to Properties

(a) Temporary pedestrian bridges Unit: No

(b) Temporary vehicular bridges Unit: No

The unit of measurement shall be the number of temporary pedestrian and vehicular bridges actually provided in accordance with the Specifications.

The tendered rates shall include full compensation for the supply, first installation, maintenance and final dismantling and removal of the temporary access bridges when no longer required, as specified in subclause PSDB 5.1.3.

PSDB 8.3.10 Moving of temporary bridges to and their re-erection in new positions

(a) Temporary pedestrian bridges Unit: No

(b) Temporary vehicular bridges Unit: No

The unit of measurement shall be the number of times each temporary bridge is moved to and re-erected in an entirely new position, excluding its first erection in the position where it was originally installed. No payment shall be made without the Employer's Agent's prior approval for moving and re-erecting a temporary bridge.

The tendered rates shall include full compensation for taking down, transporting, handling, re-erecting and maintaining the temporary bridges in the new positions."

PSDB 8.3.11 Slope Stabilisation

(a) Cross embankments Unit: m³

(b) Cross Walls Unit: m³

(c) Concrete anchor blocks Unit: m³

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised or actual dimensions, whichever is the lesser.

The tendered rates shall include full compensation for slope stabilisation as specified on drawings or authorised by the Employer's Agent. The rate shall include all material, labour, transporting and plant required.

PSDK GABIONS AND PITCHING

PSDK 3 MATERIALS

PSDK 3.1.2 Gabion cages

Gabions boxes shall be constructed of double twisted, hexagonal wire mesh of nominal 80 mm mesh, with 4,4 mm o/d frame wire and 3,7 mm o/d mesh wire complete with partition at 1 m centres.
All wire shall be mild steel to SANS 1580 - 1993, zinc coated by hot dip galvanizing to SANS 675 - 1993.

Gabions Mattresses shall be constructed of double twisted, hexagonal wire mesh of nominal 80 mm mesh, with 4,0 mm o/d frame wire and 3,5 mm o/d mesh wire complete with partition at 1 m centres.

All wire shall be mild steel to SANS 1580 - 2001, zinc coated by hot dip galvanizing to SANS 675 1997.

PSDK 3.1.3 Geotextile

In addition to the requirements of Subclause 3.1.3, the geotextile shall have a mass of at least 150 g/m² and a strength of at least 9,0 kN/m in all directions.

PSDK 3.2 PITCHING

PSDK 3.2.1 Stone

Replace the contents of Table 2 with the following:

TABLE 2: SIZE AND MASS OF INDIVIDUAL STONES FOR PITCHING

1	2	3	4
Size/mass of pitching	Thickness of pitching mm, min	Least dimension mm, min	Mass kg, min
Extra heavy	600	300	180
Heavy	400	190	50
Medium	300	150	27
Light	200	110	11

PSDK 5 CONSTRUCTION

PSDK 5.3.1 General

Notwithstanding the provisions of this Clause the excavation footing trench shall be backfilled with class 20/19 concrete to the proposed top level of the pitching.

PSDK 5.3.2 Grouted pitching

Add the following:

"The exposed stone surfaces shall be cleaned of excess mortar within 1 day of being grouted."

PSDK 5.3.3 Grouted pitching

Replace the words "(Table 4)" in the second line of the first paragraph with "(Table 2)".

PSDK 8 MEASUREMENT AND PAYMENT

PSDK 8.2 SCHEDULED ITEMS
Replace the heading and contents of Clause 8.2.1 with the following:

"PSDK 8.2.1 Surface preparation for bedding of gabions and pitching ..... Unit: m^2

The rate tendered shall cover the cost of all labour, plant and equipment required to effect minor trimming and shaping as well as compact any loose material to leave a firm flat surface, ready for bedding the gabion cages, mattresses and pitching."

PSDK 8.2.5 Pitching

Notwithstanding the provisions of this Clause the excavation and backfill of footing trenches will be measured for payment under PSDK 8.2.8.

PSDK 8.2.8* Excavation and concrete backfill of footing trenches for pitching.....Unit: m^3

The rates tendered shall cover the cost of excavating footing trenches over the lengths, widths and depths ordered as if in soft material, trimming trenches, compacting inverts, class 20/19 concrete backfill, as well as the cost of loading, transporting within a free haul distance of 0,5 km and disposal of excavation material as directed.

The volume will be computed from the dimensions ordered. No payment will be made for over-excavation or resultant additional concrete backfill."

PSG CONCRETE (STRUCTURAL)

PSG 2 INTERPRETATIONS

a) General

ADD THE FOLLOWING:

"Construction joint.
A joint required on account of constraints or convenience in the method of construction and that is not a movement, contraction or expansion joint.

Extender:

Material which, when placed with Portland Cement, has a cementing property and is used as a portion of the cement in a concrete mix for economic reasons or for the chemical or physical properties (or both) that it gives to the concrete mix.

Cementitious binder (also referred to as binder):
Common cement that complies with the requirements of SANS 50197-1, and blends of certain types of common cement and cement extenders that comply with the requirements of SANS 55167-1 (2011), SANS 50450-1&2 (2011), SANS 53263-1&2 (2011) and SANS 50934-2&6 (2011) as applicable.

Water/cement ratio:
Ratio (by mass) of the water to the cementitious binder in a concrete mix.

Immediate protection of concrete:
The prevention of moisture loss from the concrete from the time of compaction until full wet-curing is possible"

PSG 2.4 EXPLANATION OF TERMS

PSG 2.4.1 Exposure Conditions

All concrete on the Works shall be as specified for severe exposure condition.

PSG 2.4.2 Joints

Notwithstanding Subclause 2.4.3, "designated joints" will only be joints that are shown on the drawings. Any other joints that are required by the Contractor as a result of his construction constraints or for any other reason, whether approved by the Employer's Agent or not, will not be considered to be designated joints as defined in Subclause 2.4.3, i.e. they will be considered to be "non-designated" joints.

PSG 3 MATERIALS

PSG 3.2 CEMENT

PSG 3.2.1 Applicable Specifications

Replace the contents of this subclause with the following:

"Subject to the provisions of 3.2.2, cement shall comply with the requirements of SANS 50197-1 for CEM I 42, 5 or CEM I 52.5."

PSG 3.2.2 Alternative types of cement

Replace the contents of this subclause with the following:

"Only CEM I 52.5 or CEM I 42.5 (Portland Cements), CEM II A 52.5 or CEM II A 42.5 in accordance with SANS 50197-1 may be used. Further blending with a suitable extender shall be as per PSG5.5.1.7 and PSG 5.5.11.

If the Contractor wishes to use any other type/blend of cement, he shall obtain the Employer's Agent's prior written approval. The tendered rates, however, shall be based on the use of the above-mentioned cements/blends only.
The test results conducted to evaluate the conformity of cement in terms of SANS 50197-1, Clause 9, shall be made available to the Employer's Agent at least 28 days before the materials are used for concrete."

PSG 3.2.3 Storage of cement

Add the following:

"Cementitious binder shall be used in the order in which it is received. Cementitious binder shall not be stored for longer than 10 weeks without the Employer's Agent's permission."

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 3.4.5* Aggregate for grouting

Notwithstanding the requirements of Subclause 3.4.1, the grading of the fine aggregate (sand) and coarse aggregate (stone or pea gravel) to be used for grouting shall conform to the gradings given in Tables 1 and 2 respectively, below.

TABLE 1 – SAND	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5 4,75 1,18 0,3 0,15	100 95 - 100 45 - 65 5 - 15 0 - 5

TABLE 2 - STONE OR PEA GRAVEL	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5 4,74 2,36	100 95 - 100 0 - 5

"PSG 3.4.6* Samples

At least one month before commencement of concrete work the Contractor shall supply at his own cost representative samples to the Employer's Agent of the aggregates he intends using, together with certificates from an approved laboratory indicating that the aggregates comply with the specifications. Approximately 50 kg of each sample of aggregate shall be supplied.

After approval these samples shall be taken as standard for the agreed aggregates to be used in the Works. If at any time during the course of the Contract the Employer's Agent considers that there has been any deviation from the approved standard the Contractor shall submit further tested samples of material to the Employer's Agent for approval."

"PSG 3.9* ROOFING FELT

Three-ply roofing felt shall comply with the requirements of SANS 92 for type 40 felt."

"PSG 3.10* WATERSTOPS

"Waterstops shall be of approved manufacture and of the pattern and the material widths scheduled on the drawings. They shall conform to Specifications CKS 388.

All intersections between waterstops shall be prepared by mitring and welding/vulcanising intersection pieces in the factory in accordance with the manufacturer's instructions and to approval of the Employer's Agent. Only straight lengths of waterstop may be field welded, using appropriate jigs and tools.
Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. "Rearguard"-type waterstops shall have flanges or cleats that grip effectively. Where the Contractor proposes alternative products/brands, the widths, profiles, flanges and cleats shall be similar to the specified products and are subject to the approval of the Employer's Agent."

"PSG 3.11* CURING COMPOUND

Curing compound shall be white pigmented natural resin based liquid curing compound complying with ASTM 309-74. Curing compounds shall be suitable for use with potable water"

"PSG 3.12* STAINLESS STEEL

The following grades of stainless steel shall be used:

316L for welded applications,
316 for not-welded applications."

"PSG 3.13* BOND BREAKER

The bond breaker between the top of the blinding layer or dry packed mortar screed and the underside of the floor slab shall be 250-micrometre polythene sheet complying with SANS 952, Type D."

"PSG 3.14* MATERIALS FOR BUILDING WORK

PSG 3.14.1 Cement

The requirements stipulated for subclause 3.2.1 and PSG 3.2.1 shall apply.

PSG 3.14.2 Sand

Sand for mortar shall comply with SANS 1090.

PSG 3.14.3 Bricks

Brickwork shall be built in stretcher bond. The walls shall be built to the dimensions shown on the Drawings or ordered. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course.

Walls shall be carried up regularly so that no brickwork is more than 1m higher than adjoining brickwork.

All bricks shall comply with SANS 227 and shall be NFX burnt clay masonry units free of stones, cracks and other defects. The bricks shall be obtained from an approved manufacturer and samples of the bricks shall be submitted to the Employer's Agent for approval.

PSG 3.14.4 Mortar

Mortar shall comprise of the cement, lime and sand mixed in the proportions given below:

Cement: 50 kg
Lime: 0 – 40L
Sand: 130L (measured loose and damp)"

PSG 3.15 ALKALI-AGGREGATE REACTION

Reference is made to "Fulton's Concrete Technology, Chapter 10, Alkali-silica reaction."

In accordance with this reference, the Contractor shall provide the Employer's Agent with the following (with the concrete mix design submission):

- Type of coarse aggregate
- Source of coarse aggregate
- Recent SANS 6245:2006 test results (accelerated mortar prism method) for the coarse aggregate
- Certificates from cement (and extender) supplier stating the certified active alkali content(s)
- Total active alkali content of the various mix designs, adhering to the maximum values stated below (including calculations)

Result of SANS 6245 Coarse aggregate test (@12 days)	**Description**	**Limit on total active alkali content of mix (kg/m^3)**
Linear Expansion < 0.10%	Aggregate innocuous	N/A
0.10% < Linear Expansion < 0.20%	Slowly reactive/ inconclusive	2.8
Linear expansion > 0.20%	Deleteriously reactive, rapidly expansive	2.1

Over and above the table above, aggregates of the witwatersrand supergroup shall have a limit of 2.0kg/m3 active alkalis in the mix design.

The Employer's Agent may instruct a petrographic analysis of the coarse aggregate for new/unknown coarse aggregates in addition to the tests above.

All costs of the testing described above shall be deemed included in the cost of the rates for concrete.

Note: The equivalent sodium oxide content is measured as $Na_2O + 0.658K_2O$. For cement it is expressed as a percentage by mass, for concrete it is expressed in kg/m^3."

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) Two concrete mixers, each of sufficient capacity to complete a section of the wall between horizontal construction joints within 4 hours and without interruption.

(b) Two weigh-batchers to supply the mixers.

(c) Four concrete vibrators, at least one of which shall be powered by an internal combustion engine.

(d) One air compressor.

(e) Suitable and adequate Plant to transport and raise concrete and other material and equipment from ground level to the top of the structure at all stages of construction.

(f) Elevated 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 for the structure 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.

When the Contractor elects to place a crane inside the walls of the structure during the construction period, he shall communicate with the Employer's Agent in good time to ensure that the design and layout of the panels that form the roof slab and floor allow for such positioning of the crane. When sections of the roof and floor have to be redesigned to accommodate the crane, the redesign cost shall be borne by the Contractor."

PSG 4.5 FORMWORK

PSG 4.5.1 Design

Add the following:

"All formwork or scaffolding (referred from here on as temporary works) required for any part of the Works shall be designed by the Contractor. In accordance with the Construction Regulations under Section 43 of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), the Contractor shall appoint a competent person to design, inspect and approve the erected temporary works on site. Evidence of each of these processes through sign-off of the designs, inspections and approval of erection shall be submitted to the Employer's Agent throughout the project.

Before commencing with the erection of any temporary works, the design shall be submitted to the Employer's Agent for review and record-keeping. The Employer's Agent will not be responsible for approving temporary works since this remains the responsibility of the Contractor (via the

appointment of a competent person). The Employer's Agent will however have the authority to order alterations to the design or sizes of any part of the temporary works. The Contractor shall check the safety and suitability of all alterations proposed by the Employer's Agent to ensure that all temporary works is safe and proper for the execution of the Works. The fact that the Employer's Agent has altered any part of the temporary works shall not be construed as relieving the Contractor of his responsibility with regard to the strength and stability of the temporary works."

PSG 4.5.2 Finish
Add the following:

"The finish to all exposed concrete shall be smooth and that to buried or backfilled surfaces rough."

PSG 4.5.3 Ties

Add the following:

"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.

Alternative tie methods other than above may be proposed but must be qualified in the tender and will be subject to the Employer's Agent's approval.

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."

PSG 5 CONSTRUCTION

PSG 5.1 REINFORCEMENT

PSG 5.1.2 Fixing

Add the following:

"The Employer's Agent shall only inspect the reinforcing after it has been fixed in place, the formwork cleaned, cover blocks positioned and tied, 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 or,

(c) the cover as specified on the Drawings, whichever is the greater."

PSG 5.2 FORMWORK

PSG 5.2.1 Classification of finishes

(b) Smooth

Add the following:

"This finish is obtained by first giving the surface a smooth finish with the joints between formwork panels forming an approved regular pattern suitable for the appearance of the structure. All projections shall then be removed, irregularities repaired, and the surface rubbed or otherwise treated until it is smooth with an even texture, appearance and colour.

If the finish of exposed surfaces does not comply with the requirements for uniformity of the texture and appearance, the Contractor shall, when instructed to do so by the Employer's Agent, rub down the exposed surfaces of the entire structure or any part thereof as specified below, entirely at his own cost. All repairs must be completed before the rubbing commences.

The surface shall be saturated with water for at least one hour. The initial rubbing of the face shall be carried out with a medium coarse carborundum stone together with a small amount of mortar of the same cement/sand ratio as the concrete being repaired. Rubbing shall continue until all form marks, projections and irregularities have been removed and a uniform surface has been obtained. The paste produced by the rubbing shall be kept in place. The final rubbing shall be carried out with a fine carborundum stone and water. This rubbing shall continue until the entire surface has a smooth, even texture and is uniform in colour. The surface shall subsequently be washed with a brush to remove surplus paste and powder."

PSG 5.2.2 Preparation for formwork

Add the following:

"Construction joints shall be positioned as shown on the Drawings."

PSG 5.2.5 Removal of formwork

Replace Table 2 with the following table:

1	2	3	4	5	6	7	8	9	10
	Strength Class of Cement								

Formwork to Structural Member	CEM-1			CEM-II-A (or blend of CEM-I with **less** than 20% FA/GGCS /GGBS)			CEM-II-B, CEM-III (or blend of CEM-I and **more** than 20% FA/GGCS /GGBS)		
	Minimum time (24 hour periods) before removal of formwork								
	Weather								
	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold
Beam sides, walls and unloaded columns	1	1.25	1.5	1.5	2	3	3	4	5
Slabs with props left underneath	2	3	4	4	5.5	7	6	8	10
Beam soffits with props left underneath and ribs with a ribbed floor construction	3	4	5	5	7	10	10	13.5	17
Slab props including cantilevers	5	7	9	10	13.5	17	10	13.5	17
Beam props including cantilevers	7	9.5	12	14	17.5	21	14	17.5	21

Add the following subclauses:

"PSG 5.2.5.6

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.

Where walls/beams have top slabs attached, the Contractor shall keep the wall/beam propped until such a time as the top slab has attained its design strength. Back-propping of such structures shall be discussed and agreed with the Employer's Agent at the time of programme approval."

PSG 5.3 HOLES, CHASES AND FIXING BLOCKS

Add the following:

"Cover blocks shall be made of mortar to achieve a strength class (and equivalent durability) of the concrete of the element they are placed in. Cover blocks for reinforcing and fixtures may be placed into the concrete provided that neither the strength nor any other desirable characteristic (such as the appearance) of the concrete section is affected or impaired in the opinion of the Employer's Agent.

The holes or cavities left by ferrule cones in the concrete of water-retaining structures shall be filled with an approved non-shrink grout applied strictly in accordance with the manufacturer's specifications."

PSG 5.4 PIPES AND CONDUITS
Add the following:

“All pipes passing through concrete floors, walls or slabs shall be cast into the concrete member simultaneously with the casting of the member. Openings for pipes shall only be left in concrete members when so directed by the Employer’s Agent or when shown on the Drawings. Pipes shall be installed in such openings according to the details shown on the Drawings.

If water tightness is a requirement where pipes are cast into walls, floors and slabs, the Contractor shall ensure watertightness where smooth-surfaced pipes are used by using an approved method.

The cost of such method will be deemed to be included in the rates tendered for items PSG 8.9.

Openings left for pipes shall be filled with approved non-shrink grout or micro-concrete.”

PSG 5.5 CONCRETE

PSG 5.5.1 Quality

PSG 5.5.1.5 Durability

Delete Table 5

Add the following:

“The exposure conditions of the water-tight concrete are classified as **"severe"**.

The maximum allowable water : binder ratio for watertight concrete shall be **0.50**.

The maximum water : binder ratio for strength concrete shall be **0.60**.”

PSG 5.5.1.7 Strength concrete

Add the following:

"The concrete mixes shall be designed by an approved laboratory.

Design

The proportions of the various sizes of aggregate, cement and water shall be such as to produce a dense concrete of adequate workability for the particular circumstances under which the concrete will be transported, placed and compacted. Approved plasticising additives may be used, or instructed to be used by the Employer’s Agent, to ensure adequate workability in preference to varying the proportions of water or cement.

All exposed concrete shall be of the same colour. No change in materials or processes shall be made without the Contractor first satisfying the Employer’s Agent that no change in colour will result.

Trial mixes

“Whenever "Designed Mixes" are required by the Schedules of Quantities or Drawings, after approval of the aggregates the Contractor shall design for each class of concrete required for the Works, have trial mixes designed within the limits specified herein for 28 day and 7 day strengths

and he shall have cubes made and tested by an approved laboratory at his own expense. The test results of cubes made from trial mixes shall be used to determine the proportions for the "Designed Mixes" to be used in the Works.

Details of the mixes as designed shall in all cases be submitted to the Employer's Agent for approval, 30 days before concreting is carried out and no concrete shall be placed in structures before such approval in writing has been obtained. The proportions of cement, aggregates and water for each mix as approved shall not be changed except with approval of the Employer's Agent.

The Employer's Agent must receive for any particular concrete mix:

- Proportions of each design tested
- Strength of each cube tested
- Density of each cube tested
- The Contractor's nomination of the design he proposes."

PSG 5.5.3 Mixing

PSG 5.5.3.2 Ready-mixed concrete

Add the following:

"Ready-mixed concrete may be used.

Should the Contractor elect to use ready-mixed concrete in the Works he shall provide a qualified technical assistant who shall check the quality of the materials used, the accuracy and effectiveness of the water gauges and all relevant parts of the batching and mixing equipment, the moisture content of the aggregates, the quantities batched, the time of departure of each batch and all other matters which may affect the quality of timely arrival of the concrete.

The technical assistant shall commence work at the batching plant sufficiently in advance of the batching of the first mix to carry out all the required checks and shall remain at the plant throughout the period in which concrete for the Works is being batched.

The technical assistant shall maintain a continuous record of all the tests and checks carried out by him. The record shall be available for the Employer's Agent's inspection at all times and a copy of the record for each day shall be given to the Employer's Agent the following morning.

The Contractor shall further take samples for testing from every load delivered to the Site."

PSG 5.5.5 Placing

Add the following:

"Concreting of the wall between horizontal construction joints shall be carried out in both directions from a point on the wall in order to close the gap with fresh concrete.

Pumping of concrete shall not be permitted unless approved by the Employer's Agent. For such approval, the Employer's Agent may require shrinkage tests of the concrete to meet the criteria in PSG 5.5.11. The rates for concrete will be deemed to include such testing costs.

Should excessive cracking of pumped-concrete occur, the Employer's Agent may instruct the Contractor to revert to conventionally placed concrete. All costs associated with changes in mix design, site placing equipment, and any remedial repairs to concrete will be at the Contractor's expense."

PSG 5.5.6 Compaction

Delete "or (if approved)…. by spading, rodding or forking" in the first sentence of subclause 5.5.6.3.

PSG 5.5.7 Construction joints

Add the following:

"Horizontal construction joints are permitted in structure walls in positions indicated on the drawings or approved by the Employer's Agent. Vertical construction joints in the walls are subject to the written approval of the Employer's Agent and the cost of all such vertical or horizontal construction joints will be deemed to be included in the rates for cast in situ concrete. This also applies to the preparation of concrete to form construction joints in flume walls as specified on the drawings.

The construction joints in water-retaining structures shall be made strictly in accordance with the details shown on the drawings. The joints between screeds and concrete floors shall be regarded as construction joints and the surface of the floor shall be prepared as described for construction joints.

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 scrabbling of the concrete where steel reinforcement is continuous.

The walls shall be cast in lifts of a height that permits each lift to be poured without interruption in one continuous operation during normal working hours.

It is the Contractor's responsibility to ensure that construction joints are watertight. The Contractor's proposed method for ensuring the watertightness of such joints shall be submitted to the Employer's Agent for his approval.
For construction joints at kickers all additional costs for concrete, preparation, etc will be deemed to be included in the rates tendered for formwork and concrete in walls or sides and kicker joints or construction joints will not be measured separately. Kickers shall be cast monolithically with the floor/slab concrete and the Contractor shall ensure that kickers are thoroughly compacted, immediately protected, and cured using suitable techniques."

PSG 5.5.8 Curing and protection

Add the following:

"Curing shall be conducted for a minimum of 7 days. The method of curing shall be approved by the Employer's Agent for the various elements.

Concrete will not be paid for unless properly cured (including vigorous immediate protection) and proof of curing is continuously visible on Site. The cost of immediate protection and curing shall be deemed to be included in the rates for concrete.

The Contractor is to pay special attention to both the immediate protection and long-term curing of the concrete for the various elements. Where deemed necessary by the Employer's Agent, the Contractor shall submit a Method Statement for approval outlining in detail the various measures that the Contractor will need to undertake to ensure effective immediate protection and long-term curing of the concrete.

Curing compounds will not be accepted as a stand-alone system for the immediate protection of concrete. Only resin-based curing compounds complying with ASTM C309 Type 1 or 2 Class B will be accepted where approved by the Employer's Agent.

Where accepted, the curing compound shall be applied within 30 minutes of the stripping of formwork or, in the case of unformed surfaces, after a minimum of 48 hours of immediate protection. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Employer's Agent and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape."

PSG 5.5.10 Concrete surfaces

All unformed concrete surfaces shall, except where otherwise ordered, be given a steel float finish.

Add the following subclause:

"5.5.10.4 Where the surfaces of the concrete are to be additionally hardened or protected the positions of such surfaces and the method to be used will be shown on the Drawings and will be scheduled. Materials or products with a ferrous content will not be allowed.

PSG 5.5.11 Watertight concrete

Add the following:

"The mix designs for watertight concrete must be aimed at ensuring concrete durability and must therefore be guided by the need to:

- Minimise the permeability of the concrete; and
- Maximise the chemical resistance of the concrete to aggressive agents in the environment.
- Reduce the heat of hydration and thermal gradient of thick sections (greater than 400mm thick) at early-age.

The following parameters shall be adhered to:

Parameter	**Limit**
Maximum shrinkage strain (accelerated shrinkage test):	350 µm/m
Maximum water : binder ratio:	See PSG 5.5.1.5
Minimum cementitious binder content:	300kg/m^3
Maximum cementitious binder content:	380kg/m^3
Maximum water content:	185 litres/m^3
Maximum alkali content:	See PSG 3.15
Maximum thermal coefficient of expansion for concrete:	$12x10^{-6}$/°C
Minimum coarse aggregate fraction (as a percentage of total (coarse + fine) aggregates):	0.55
Type of extender required:	Ground Granulated Blast Furnace Slag (GGBS) *OR* Fly Ash (FA)
Minimum and maximum range of extender replacement (as a percentage of total binder content)	30% - 50% (GGBS) 20% - 30% (FA)

Where extenders specified may not be locally available, the Contractor should take into account all the costs required to import and batch the specified extender in the rates for concrete (Item PSG8.4.3).

The following structures shall be considered water retaining/excluding and shall require watertight concrete:

- All reservoirs (including columns and roofs) and reinforced concrete valve-chambers

Where extenders are used/specified, Table 2 (as amended) shall apply, and the immediate protection during casting and the curing of concrete should be given special attention by the Contractor."

Add the following subclauses:

"PSG 5.5.16 Applied loads

No crushed-stone covering or any other loads shall be placed on the roof of the structure before the concrete has attained its design strength, unless approved supports are provided."

PSG 5.5.17 Pipes and conduits

All pipes passing through concrete floors, walls or slabs shall be cast into the concrete member simultaneously with the casting of the member. Openings for pipes shall only be left in the concrete members when so directed by the Employer's Agent or when shown on the Drawings. Pipes shall be installed in such openings according to the details shown on the Drawings.

If watertightness is a requirement where pipes are cast into walls, floors and slabs, the Contractor shall ensure watertightness where smooth-surfaced pipes are used by using an approved method prior to casting in. The cost of such method will be deemed to be included in the rates tendered for item PSG 8.9.

PSG 5.5.18 Soilcrete

Where soilcrete is specified for filling, the soilcrete shall comply with the requirements of subclause PSDB 3.5 (d) of SANS 1200 DB and shall be placed as specified in the subclause.

PSG 5.5.19 Brickwork

Brickwork shall be carried out as specified for manholes in subclause 5.6.4 of SANS 1200 LD using bricks conforming to the requirements for bricks as per subclause 3.5.1 of SANS 1200 LD.

Brickwork shall be built in stretcher bond to the dimensions shown on the Drawings. All bricks shall be well soaked in water immediately before being laid and the previous course of bricks shall be well wetted before the laying of the following course.

PSG 5.5.20 Plasterwork

Plasterwork shall consist of a single coat, comprising one application of a 1 : 4 cement : sand mixture with a wood float finish. The thickness of the plaster shall be between 13 and 20 mm. All plaster shall be finished smooth, shall be plumb and corners shall be rounded and square.

PSG 5.5.21 Granolithic screed/benching

Granolithic concrete shall consist of 1 part of cement, 1,5 parts of sand and 3 parts of 9,5 mm maximum size aggregate by volume. In all other respects it shall comply with the specifications clauses for concrete.

The contact surface of the base concrete shall comply with the requirements for a Degree of Accuracy II finish.

Immediately before placing the granolithic concrete, the base concrete shall be thoroughly cleaned by scrubbing, all the standing water then removed, and a 1:3 cement mortar grout of thick cream consistency well brushed into the prepared surface, the granolithic concrete shall then be applied before the cement grout sets. The granolithic concrete shall not have a slump exceeding 50 mm.

It shall be brought true to profile as shown on the Drawings with a Degree of Accuracy I finish.

PSG 6 TOLERANCES

PSG 6.2 PERMISSIBLE DEVIATIONS

PSG 6.2.3 Specified permissible deviations

Add the following:

"Degree of Accuracy II is applicable, except where specifically shown otherwise on the Drawings.

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 Clause 6.2.3(a)(3) with the following:

	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
"Cover to reinforcement (see (e) below).....	-0+20	-0+10	-0+10

Replace Clause 6.2.3(d)(5) with the following:

	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
"Vertically, per metre of height	5	3	2
subject to a maximum of	50	30	10”

Add the following:

“(h) Floors

The maximum permissible deviation from a 3 m long straight line connecting two points on the surface of the finished floor is ± 3 mm.

PSG 7 TESTS

PSG 7.1 FACILITIES AND FREQUENCY OF SAMPLING

PSG 7.1.1 Facilities

Add the following:

"The Contractor shall provide sufficient storage capacity for the concrete test cubes and shall arrange to have them tested by an approved laboratory.

The cost of all testing, including the cost of sampling, storage and the transport of samples shall be included in the rates tendered for concrete work."

PSG 7.1.2 Frequency of sampling

Notwithstanding the requirements of this subclause, the Contractor shall take note that he is responsible for taking an adequate number of tests to ensure that the concrete being used complies with the specification. The Employer’s Agent will only carry out such control testing as he may require.

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. Samples for testing shall be taken of such concrete at the point of placing.

The rates of sampling and testing will be selected by the Employer's Agent depending on the magnitude of the Works and daily pours. At least one sample (sufficient for 6 cube moulds) shall be taken from each day's casting and from randomly selected daily batches to represent an average volume of not more than those given in the table below. Each sample shall be taken from one particular batch.

Rate 1 Highly Stressed Structure	Rate 2 Ordinary Structure	Rate 3 Mass Concrete
10 m^3 or 10 batches	20 m^3 or 20 batches	50 m^3 or 50 batches
Whichever is the lesser volume		

Unless otherwise agreed by the Employer's Agent tests shall be carried out in an approved laboratory and certified copies of all test results shall be submitted to the Employer's Agent immediately after the test.

Compliance with the specified characteristic strength will be judged by tests made on cubes at an age of 28 days. Tests shall also be made at 7 days.

Not more than 5 % of the tests shall fall below the specified strength.

The average strength determined from any group of three consecutive test cubes shall exceed the specified strength by not less than 7,5 MPa.

Each individual test result shall be greater than 85 % of the specified strength.

When the average strength of three consecutive test cubes fails to meet the second of the above requirements, the mix proportions of subsequent batches of concrete shall be modified to increase the strength.

Where durability and impermeability are prime considerations, the Employer's Agent may order the density of wet concrete to be measured regularly as a check on the concrete mix. This shall be done by placing a sample of concrete being poured in a standardised container, compacting by vibration and then determining the density.

The Employer's Agent may also order tests on the hardened concrete in the structure. These may include non-destructive methods or the taking of cored samples.

In evaluating test results, the Employer's Agent will take the following into consideration:-

(i) The validity of test results.
(ii) Confirmation that specimen sampling and testing has been carried out in accordance with BS 1881.2
(iii) The mix proportions actually used in the concrete under investigation.
(iv) The actual section of the structure represented by the test cube/s.

(v) The possible influence of any reduction in concrete quality on the strength and durability of the affected section of the structure.

The Employer's Agent may thereafter declare the concrete to be defective and order action to be taken as specified."

Add the following subclause:

"PSG 7.3.6 Disinfection of Structure

Before testing for watertightness, the reservoir shall be thoroughly cleaned out, pressure sprayed and washed down with clean water and thereafter with the disinfect solution.

The roof soffit, beams, columns and walls shall be thoroughly sprayed down and the floor scrubbed with the solution specified in subclause 5.10 of SANS 1200 L.

On completion of the disinfection, the disinfectant solution shall be run to waste before the reservoir is filled for testing for watertightness. Disinfection is to be witnessed and approved in writing by the Employer's Agent before watertightness testing may commence.

Should any further work be necessary in the reservoir after testing, the reservoir shall be disinfected at the Contractor's expense."

Add the following subclause:

"PSG 7.3.7 Testing structure for watertightness

Water (potable) for testing shall be provided by the Contractor and he shall be responsible for providing all necessary equipment that may be required for filling the structure. Such water will not be available by means of the newly installed inlet pipework for each reservoir.

The cost of purchasing and transporting the potable water required for testing shall be covered separately under a provisional sum allowance in Section 1 Item 3.2. Upon agreement and instruction of the Employer's Agent, the Contractor is to take measures to fill the reservoirs with potable water by carting of water from an alternative source (Mthatha furthest), using a minimum 10kl size water truck. The Contractor shall ensure that potable water is in no way compromised during the pumping/transportation.

The method of filling the reservoir with potable water is to be approved by the Employer's Agent. Any drop in water during the stabilisation period that requires topping up of the reservoir is to be included in the provisional sum allowance. Any costs to refill the reservoir due to leaking or retesting of the structure after repair is for the Contractor's account."

The structure shall be filled with water at a uniform rate not exceeding 2,0 m in 24 hours 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 water level shall be maintained by the addition of further water for a stabilizing period to permit complete absorption of water by the concrete.

The stabilizing period shall be 21 days. After the stabilizing period, the level of the liquid surface shall be recorded at 24-hour 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, if applicable, shall not exceed 1/500th of the average water depth of the full tank, or 10 mm.

Should the structure not satisfy the 7-day test, then, after the completion of remedial work, it shall be refilled if necessary, left for a further stabilisation period, a further test of 7 days duration shall then be undertaken in accordance with this clause.

In the event of appreciable leakage being evident at any stage of the filling or testing or in the event of the Employer's Agent considering the final degree of watertightness to be unsatisfactory, the Contractor when ordered by the Employer's Agent shall discontinue such filling or testing and shall, at his own expense, take approved steps immediately to rectify the leakage, until a satisfactory test is obtained, which shall prove to the Employer's Agent that a sufficient degree of watertightness has been obtained. It is noted that leaking cracks that do not self-heal in the stabilisation period will be considered defects in the test and will require suitable/approved repair.

The costs of emptying the water-retaining structure which cannot be drained shall be borne by the Contractor.

The water shall be discharged in a manner approved by the Employer's Agent and shall be such that the Employer can utilise the water if he so desires.

The water shall further not be used as a medium for additives to effect remedial work or to stop leaks.

The costs of retesting the structure for watertightness shall be borne by the Contractor, including the cost to obtain water required for such retesting.

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1 MEASUREMENT AND RATES

PSG 8.1.1 Formwork

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 25 mm x 25 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 reservoirs, 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 8.1.2 Reinforcement

Replace the contents of this Clause 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 kilogram of fabric reinforcement in place, and the quantity shall be calculated from the net area covered by the mesh, excluding overlaps.

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 8.1.3 Concrete

Add after "mixing, testing" in the second line of subclause 8.1.3.3(a) "including transport to an approved laboratory,"

Add the following to PSG 8.1.3.3(a):

The tendered rate for walls shall also include for forming vertical joints where authorised."
Delete ", or the plan size of the excavation where additional excavation is provided to facilitate erection of forms" from the second line of paragraph 8.1.3.1(c).

Add the following to PSG 8.1.3.1(d):
"Strip foundations and encasement of pipes shall be cast directly against the sides and bottoms of excavations.

No payment shall be made for additional concrete in overbreak."

PSG 8.2.5 Narrow Widths

Add the following:

"Widths in excess of 300 mm shall not be regarded as narrow widths."

PSG 8.2.6 Box out holes / Form voids

Replace the heading of item (d) with the following:

“Large other than circular, of area over 0,1m² up and including 5m².”

PSG 8.4 SCHEDULED CONCRETE ITEMS

PSG 8.4.3 Strength Concrete, Grade

Replace "Unit: m^3" with "Unit: m^3 or m^2"

Add the following after the last sentence:

"In the case of structural floor screeds, the unit of measurement shall be the square metre and the average thickness and proportions will be stated."

PSG 8.5 JOINTS

Replace “Unit: m” with “Unit: m or m²”.

“PSG 8.9* Inserts (type of description stated) ……Unit: No

The tendered rate shall cover the cost of taking delivery, installing and fixing in position as detailed, for splitting and cutting the formwork where required, dealing with the reinforcement, ensuring watertightness and casting into concrete of the scheduled items and shall further include all clearing and cleaning preparation as well as for finishing.

Pipes for casting into concrete will be measured elsewhere.

The provision of the items to be built in and fixed will, except if otherwise stated, be measured for payment elsewhere.”

PSG 8.11 BRICKWORK Unit: m²

Separate items will be scheduled for brickwork of different thicknesses and classes.

The unit of measurement shall be the nett area (on elevations) of brickwork constructed to the specified thickness, measured in square metres.

The tendered rate shall include full compensation for constructing the brickwork as specified including the provision of all materials and cleaning up on completion of the work.

PSG 8.12 PLASTERWORK:

(a) Plaster (state thickness) Unit: No
(b) Fillets, skirtings, etc (state dimensions) Unit : m

The unit of measurement for subitem (a) shall be the nett area of plasterwork constructed to the specified thickness, measured in square metres or for subitem (b) the nett length of corner filters, skirtings, etc constructed to the specified dimensions, measured in linear metres.

The tendered rate shall include full compensation for constructing the plasterwork including the supply of all materials, mixing, applying, finishing, rounded corners and all else that may be required to complete the work as specified.

PSG 8.13 SCREEDS:

(a) 1:3 floor screeds with falls including V-joints to form panels and a smooth steel trowelled finish/power float finish to top:

(i) Description of application and thickness Unit: m^2
(ii) Etc for other applications and thicknesses

The unit of measurement shall be the square metre of screeds constructed.

The tendered rate shall include full compensation for constructing the screeds as specified including the supply of all materials, preparing the concrete surface to receive the screeds and for all else that may be necessary to complete the work.

PSG 8.14 CAST IN OF PIPES WITH OR WITHOUT PUDDLE FLANGES:

(a) Up to 300 mm nominal bore:

(i) Through (description and thickness of structure elements) Unit: No.

(b) Over 300 mm up to 600 mm nominal bore:

(i) Through (description and thickness of structure elements) Unit: No.
(ii) Etc for other nominal bores in increments of 300 mm

The unit of measurement shall be the number of each size of pipe installed.

The tendered rates shall include full compensation for installing the pipe where new pipes are used (with or without a puddle flange) in the exact position as shown on the drawings, for splitting or cutting the formwork where required, for ensuring watertightness where required and for all additional costs required to install the pipes specified or shown on the drawings.

New pipes shall be measured under the items of the relevant section of the specifications.
“PSG 8.15* ALTERNATIVE METHODS OF FILLING OF STRUCTURES FOR WATERTIGHTNESS TESTING

(a) (Structure stated) Unit: No.

The unit of measurement shall be the number of each structure successfully disinfected and filled to the TWL and maintained (refilled if necessary, as per the watertightness test) at that TWL during the stabilisation period and passing the specified watertightness tests to the satisfaction of the Employer’s Agent.

The sums tendered shall cover the cost of all labour, plant and materials to disinfect, fill the reservoir and keep it filled during stabilisation as well as for the disposal of the disinfectant. The

tendered rate shall however not include the cost to procure and cart water from Mthatha (furthest). A provisional sum allowance has been made for the purchasing and carting of water under BOQ Section 1 Item 3.2.

Any costs to refill the reservoir due to leaking or retesting of the structure after repair is for the Contractor's account."

PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS)

PSHA 3 MATERIALS

PSHA 3.1 STRUCTURAL STEEL

Add the following:

"Where stainless steel is to be used, the grade shall be 316 or as shown on the Drawings."

PSHA 5 CONSTRUCTION

PSHA FABRICATION AND ASSEMBLY

PSHA 5.2.2 Cutting

Add the following:

"The edges of flame-cut plates shall be ground smooth."

PSHA 5.2.4 Welding

The Contractor shall submit with his shop Drawings full details of welding procedures. All welds shall be continuous.

Unless otherwise approved no longitudinal or overhead welding shall be carried out on site. Under no circumstances will cutting and welding of grid covers and frames be permitted on site.

Welders undertaking manual welding of permanent steelwork shall be experienced and competent artisans.

PSHA 5.2.7 Ladders

Replace the heading of with "Ladders and Step Irons"

Add the following:

"Ladders and step irons shall be of stainless steel grade 316 as specified."

"PSHA 5.2.8.3* All open grid floors and frames shall be stainless steel grade 304 as detailed. All open grid floor panels shall be open-ended as specified, except where bonding is specified on the Drawings. Cut outs shall be provided where indicated on the Drawings"

PSHA 8 MEASUREMENT AND PAYMENT

PSHA 8.3 SCHEDULED ITEMS

Replace the heading of subclause 8.3.1 to read:
"PSHA 8.3.1 Structural steel for: (Type of structure indicated) …….. Unit: t, No or Sum"

Add the following after the last sentence of subclause 8.3.1:

''Alterations to existing structural steelwork will be described in the schedule and measured in number. Rates for these items shall include full compensation for all labour tools, storing, additional steelwork, reinstallation, cleaning

"PSHA 8.3.3 Ladders, complete and installed……. Unit: No"

Add the following:

"Separate items will be scheduled for ladders of different materials, dimensions and height.

PSL MEDIUM PRESSURE PIPELINES

PSL 3 MATERIALS

PSL 3.1 GENERAL

Add the following paragraphs:

"Each type of pipe delivered to the Site shall have a standard length corresponding with the standard lengths offered by the pipe manufacturer in his catalogue, with a maximum permissible variation in length of ± 2%.

A pipe that is a shorter or longer than the defined standard will be rejected by the Employer's Agent, except when such non-standard lengths are required in terms of the Contract and have been specifically manufactured or cut as such by the pipe manufacturer or supplier."

PSL 3.4 STEEL PIPES, FITTINGS, AND SPECIALS

PSL 3.4.2 Pipes of nominal bore up to 150 mm

Add the following:

"The pipes shall be 'normalised' or seamless steel pipes and shall be used with malleable cast-iron fittings complying with the requirements of SANS 14.

Where flanges are required, they shall comply with SANS 1123 table 1600 unless otherwise indicated on the Drawings."

PSL 3.7 OTHER TYPES OF PIPES

Replace the heading and contents of subclause 3.7.1 with:

"PSL 3.7.1 uPVC pipes and fittings

uPVC pipes and fittings shall be provided with spigot and socket rubber ring joints and shall comply with SANS 966-1 and shall carry the SABS mark. Solvent welded fabricated fittings will not be acceptable.

"PSL 3.7.2 Polyethylene pipes and fittings

"Polyethylene pipes shall be black HDPE type IV pipes and shall comply with SANS/ISO 4427 and shall carry the SABS mark, manufactured from PE80 or PE100 material with a nominal pressure rating (PN) as indicated on the Drawings and scheduled in the Bill of Quantities.

The HDPE pipes shall be joined together by means butt-welded joints. Where HDPE pipes is to be connected to steel flanges, this shall be done with HDPE stub-flange, supplied with gasket and grade 316 stainless steel backing ring and fasteners.

Compression fittings to be used with HDPE pipes and shall be "Plasson", "Alprene" or approved equivalent with a nominal pressure rating (PN) as indicated on the Drawings and scheduled in the Bill of Quantities."

"PSL 3.7.3 mPVC pipes and fittings

mPVC pipes and fittings shall be provided with spigot and socket rubber ring joints and shall comply with SANS 966-2 and shall carry the SABS mark. Solvent welded fabricated fittings will not be acceptable."

"PSL 3.7.4* Copper tubing and fittings

Copper tubing shall be class 0 and comply with the requirement of SANS 460. Fittings shall be brass "Conex" compression fittings to SANS 1067 and shall carry the SABS mark."

PSL 3.8.3 Flanges and accessories

Add after "insertion piece" in the second line "consisting of a full face gasket".

Notwithstanding the provisions of this clause, Flanges shall comply with SANS 1123 or BS EN 1092 unless required to match existing flanges. Raised face flanges shall be provided for pipework of PN 25 and higher. Flange drilling shall be "off centre" unless required to match an existing flange which is drilled otherwise. The jointing material used on flanged joints shall be of a suitable rubber or compressed mineral fibre at least 3mm thick complying respectively with BS EN 681 or BS EN ISO 23936, as applicable. Gaskets shall be full face. Properly designed O-ring seals are also acceptable subject to receiving approval from the Employer's Agent.

All fasteners, including studs welded to flanges, shall be of stainless steel grade 316 and shall comply with EN ISO 3506-44, as applicable.

All pipes, specials and fittings shall be supplied complete with all necessary stainless steel grade 316 bolts, washers and nuts as well as appropriate full face insertion pieces, applicable to diameter and material.

PSL 3.8.4 Loose flanges

Bolts and nuts shall comply as stated in PSL 3.8.3.

Add new subclause

"PSL 3.8.8* Orifice Plates

Orifice plates shall be manufactured from 10mm thick grade 316 stainless steel and shall be inserted between flanges where it is stated in this document and or the Drawings that orifice plates are required. The orifice shall be sharp edged, double bevelled, with a 4mm edge and shall be manufactured by an approved supplier."

PSL 3.9 CORROSION PROTECTION

PSL 3.9.1 CI pipes

"Notwithstanding the provisions of this subclause, all CI pipes, fittings, specials, valves, meters and hydrants shall be coated internally and externally using "Rilsan" or equivalent to a dry film thickness of at least 200 micron. The coating shall be applied by an approved applicator. Fusion

bonded epoxy (FBE) coating applied internally and externally to SANS 1217 or DIN 30677 will also be accepted".

PSL 3.9.2 Steel pipes

PSL 3.9.2.1 Steel pipes of nominal bore up to 150 mm

Add the following:

"Steel pipes utilised for the air vent shall be galvanised only as shown on the Drawings. Steel pipes, fittings and flanges within the chambers shall be hot dip galvanised and FBE coated after fabrication, in accordance with the requirements of SANS 32 for heavy duty applications. Further machining, cutting or welding after hot dip galvanizing will not be allowed. Fusion bonded epoxy (FBE) coating shall comply with the provisions of SANS 1217 or DIN 30677 will also be accepted"

PSL 3.9.2.2 Steel pipes of nominal bore over 150 mm

Add the following:

"Steel pipes shall be hot-dip galvanised where shown on the Drawings and as specified in sub-subclause 3.9.2.1. The hot-dip galvanising shall comply with the requirements of the hot-dip galvaniser's Association of South Africa"

PSL 3.9.6 Corrosive soil

Add the following:

"Where shown on the Drawings, steel pipes in contact with corrosive soil shall be wrapped with Densopol 80 HT or an equivalent approved product, strictly in accordance with the manufacturer's instructions."

PSL 3.10 VALVES

Replace the contents of this subclause with the following:

"Definition of valves will be deemed to also include water meters and Prefabricated Break Pressure Tanks (BPTs).

Valves shall comply with the following requirements in addition to the Specification per valve type detailed below.

- Meet a minimum Pressure Class of 25 bar and or the pressure class as stated in the BOQ, in cases where the BoQ does not specify a pressure class, it shall be taken as 25 Bar.
- They shall be complying with SANS 664/1974 with pressure class as per the Drawings and Bill of Quantities.
- They shall comply with the requirements of SANS 1123 and further specified in this Specification and Bill of Quantities.

- Valves shall be coated before delivery, both internally and externally with a suitable bitumastic paint free of phenols."

PSL 3.10.1 Gate Valves

The following type of gate valves shall be used on this project as measured in the Bill of Quantities

- Flanged gate valves with spindle cap or handwheel (AVK Series 43/60 RSV valves or approved equivalent)
- Flanged Gate Valve with spindle cap (AVK Series 06/40 or approved equivalent)
- Flanged Gate valve with handwheel (AVK Series 06/40 or approved equivalent)
- Socketed gates valves for uPVC pipes shall be AVK Series 01/60 RSV valves or approved equivalent
- Class 8 "Prestex" (Cobra) or similar approved cast brass full way gate valves complying with SANS 776-1975 shall be used. The valves shall be fitted with non-rising spindles and guided wedges and shall have taper threaded female end connections.

A valve shall be provided with double flanged or double spigoted or double socketed end connections, as billed. Unless otherwise billed, it shall be supplied complete with all jointing material such as insertions, rings, packings, bolts, nuts and washers etc. as necessary for the type of connection billed.

PSL 3.10.2 Air valves

The following type of valves shall be used on this project as measured in the Bill of Quantities

- Three pieces full-bore stainless-steel ball valve
- Three stage double orifice air release and vacuum break valve (Vent-o-Mat model RBX or similar approved air valve)

The valves shall further be as specified on the Drawings and in the Bill of Quantities in terms of size, connection type, pressure rating and model number.

Each air valve shall be supplied with:

i) a bronze isolation cock, (for DN 25 valves only), and
ii) flanged isolating RSV gate valve as specified in this document, and with or without bevel gears and spindle cap or handwheel as specified
iii) three-piece full-bore stainless-steel ball valves with PTFE seats as supplied by Vac-Cent Services, or approved equivalent. The maximum working pressure of 16 bars.

Each double or multiple orifice air valve (flanged) shall be fitted with a suitable drain cock to release the pressure inside the valve when the isolating valve is closed at a time when the float is sealing the large orifice.

Double and Triple orifice air valves shall be provided with cast iron shield plates so designed as to prevent the entry of dirt when the large orifice is open.

Flanged end connections shall comply with SABS 1123 for a nominal pressure corresponding to that of the water meter and the stated working pressure of the adjacent pipework.

The meter design shall provide for a reasonable clearance behind the rear face of flanges to allow access to e.g. bolts and nuts for installation and removal. The flow rate shall be between 0.35m3/h – 2000m3/h and the maximum working pressure of 16 bars. The accuracy of the meter shall be guaranteed equal or better than ± 0.5% of the measured value.

PSL 3.10.4 Check valves

Check valves shall be AVK Series 53/35 or similar approved resilient seated ball check valves. The ball shall be ductile iron, vulcanised with NBR rubber and shall be of the full-bore type. It shall be externally and internally coated with epoxy coating to DIN 30677. The valve shall further be pressure rated to 20 bar.

The valve shall be suitable for horizontal or vertical mounting, of robust construction, and shall close drop tight at the required operating head. Access to the moving parts shall be possible without removing the valve from the line. In addition, the following shall apply:

a) For flanged check valves:
   i) the valve shall be double flanged;
   ii) the body, cover and door shall be of close-grained cast iron;
   iii) the door shall be fitted with a zinc-free phosphor-bronze face closing on a corresponding bronze face in the body, and
   iv) the door suspension lugs shall be hinged on a long zinc-free, phosphor-bronze spindle supported in trunnion bearings on both sides of the body;

b) For wafer type spring check valves:
   i) the discs shall be either stainless steel or carbon steel with resilient seats, and

   ii) the valve bodies shall be manufactured of the materials specified.

PSL 3.10.5 Control valves

The following type of level and flow control valves shall be used on this project as measured in the Bill of Quantities

For the reservoirs, the following control valves shall be used

- Bermad WW-EN-750-03-66-3Q-Y-C-16-EB-PB-F or similar approved, flow control with Bi-Level and Anti-Surge Closing
- DN50 Equilibrium (ball) float control valves, PN16, with flanged end, or similar approved.

PSL 3.10.6 Prefabricated Break Pressure Tanks (BPTs)

The following type of BPT shall be used on this project as measured in the Bill of Quantities

The LW Tank Systems Prefabricated stainless steel BPTs or similar approved shall be used. The model numbers for the BPTs to be used as below.

- LWTS-50-BPT-01 or similar approved
- LWTS-80-100-BPT-01 or similar approved

PSL 3.11.1 Bricks

Bricks complying with the details shown on the Drawings and Bill of Quantities shall be used.

PSL 3.11.4 Step irons

Step irons complying with the details shown on the Drawings shall be used.

PSL 3.11.5 Manhole covers and frames

The requirements of the subclause shall apply, except that the type of cover and frame to be used shall be as detailed on the Drawings.

PSL 3.11.6 Surface Boxes

All surface boxes, including air, scour and inlet chambers shall be as specified and detailed on the Drawings.

PSL 3.13 PROTECTION DURING STORAGE, HANDLING AND CONSTRUCTION

The Contractor shall satisfy the Employer's Agent that the manufacturer's recommendations for good practice for the transporting, handling, stacking, storing and installing of pipes, pipe fittings, seal rubber etc. are being diligently followed. The Employer's Agent's Representative shall be given the opportunity to inspect all materials immediately upon delivery and prior to installation and shall have the right to reject any materials which, in his or her opinion has / have suffered damage which may impair the long-term durability and or strength of said items.

Pipes and specials shall be protected against damage during all stages of manufacture, delivery, storage and handling.

PSL 5 CONSTRUCTION

PSL 5.1.1 General

Add the following to Clause 5.1.1:

"PVC pipes shall be laid, cut and jointed strictly in accordance with the manufacturer's instructions. A pipeline shall further be laid continuously; the leaving of gaps for fittings will not be permitted.

Where applicable, pipes to be laid in a combined trench shall further be laid so that their joints are directly opposite one another and so that all pipe markings printed on the pipes are positioned at the top."

PSL 5.1.4 Depths and cover

Notwithstanding the requirements of this Subclause, the pipeline shall be laid to the levels shown on the Drawings or as ordered by the Employer's Agent.

Add the following new subclause under PSL 5.1.4

"PSL 5.1.4.6* Position of spindle of gate valves

The top of the spindle of a gate valve shall not be less than 75 mm nor more than 600 mm below the level at which the soffit of the valve box is to be set. To ensure the aforementioned, valve spindle extension pieces shall be fitted by the Contractor, complete with stabilisers, where required."

PSL 5.6 VALVE AND HYDRANT CHAMBERS

PSL 5.6.1 General

Replace the words "drawing L-1" *in the second line with* "the Drawings".

PSL 5.6.2 Construction of chambers

Replace the words "drawing L-1, L-2 and L-3" *in the fourth line with* "the Drawings".

Add the following subclauses:

"PSL 5.11 STANDPIPES

Standpipes shall be erected in the positions and to the details shown on the Drawings.

PSL 5.12 MARKER BLOCKS

Type 1 and Type 2 marker blocks shall be manufactured and positioned as shown on the Drawings.

PSL 5.13 PIPELINE ROUTE MARKERS

Route markers for the various water pipelines shall be erected in the positions and shall be manufactured according to the details shown on the Drawings."

PSL 7 TESTING

PSL 7.3 STANDARD HYDRAULIC PIPE TEST

PSL 7.3.1 **Test pressure and time of test**

PSL 7.3.1.2 The maximum working pressure for the different pipes is indicated by the class of the pipe.

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.1 GENERAL

Replace the second sentence of this Clause with the following:

“No payment will be made for depths of excavation in excess of those specified unless ordered in writing by the Employer’s Agent.”

PSL 8.2 SCHEDULED ITEMS

PSL 8.2.1 Supply, lay and bed pipes complete with couplings .....Unit: m

Add the following:

“The rate tendered shall further cover the cost of the work provided for under 8.2.4, for the supply and installation of all stainless-steel bolts, nuts, washers, insertion pieces, for corrosion protection as specified, and with respect to testing, for the supply and installation of all equipment, fittings and specials required, as well as the cost of water drawn and the disposal of the sterilisation solution. The measured quantity of pipe length will not, except for the payment of materials on site, be measured for payment until the length under consideration has been accepted in terms of subclause 7.3, PSL 7.3.1 and 7.3.3.

“The Contractor shall be responsible for all costs associated with obtaining water for pressure testing of the pipelines. Programming of the testing and commissioning of the scheme should be performed such that once watertightness testing of the reservoirs has been successfully completed, the water inside the reservoirs can be used to test and commission the installed pipelines. No additional provision or payment will be made for water required for testing the pipelines.
The contractor would be required for testing /commissioning/repairing work done by others and accept responsibility/liability for the work done by others following his testing.

The Contractor will be allowed to claim the following percentages for interim payment purposes as the various activities are completed:

Stage of Completion	Percentage Applicable
Pipes laid, fully bedded and backfilled in trench	85.00%
Pipes cleaned, disinfected and tested successfully.	100.00%

Note that the percentage applicable is given in the above table as a cumulative figure."

PSL 8.2.2 Extra over 8.2.1 for the supplying, laying and bedding of specials complete with couplings

..... Unit: No

"Tees

Specials will be measured by number, extra over the cost of the installation of the pipes. The tendered rate shall include the supply, lay, bedding, jointing and testing of the specials.

The tendered rate for specials shall be held to include machine collars (where required) on the specials and the couplings / welds necessary to fit the special to the associated pipeline and one set of bolts, nuts and gaskets per flanged special.

Mechanical couplings shall be measured separately by number. The tendered rate shall also include for petroleum mastic and tape wrapping where mechanical couplings and flanges are buried.

Bends

Bends will be measured by number, extra over the cost of the installation of the pipes. The tendered rate shall include the supply, lay, bedding, jointing and testing of the bends. The tendered rate shall also include the cutting of pipes, preparation of pipe ends and repair of corrosion protection (where required)"

PSL 8.2.3 Extra over 8.2.1 for the supplying, fixing and bedding of valves .... Unit: No

Add the following:

"The rate tendered shall also as applicable cover the cost of the provision of corrosion protection as specified as well as the supply and installation and testing of all stainless-steel bolts, nuts, washers, insertion pieces, as required."

PSL 8.2.4 Extra over 8.2.1 for the cutting of the pipe and the supplying and fixing of the extra coupling

Delete this Clause:

Provision has been made under PSL 8.2.1 for the measurement and payment of work included under this Sub-Clause.

PSL 8.2.11 Anchor blocks/Thrust blocks and pedestals

Insert "concrete" *before* "and" *in the last line of the last paragraph*.

REPLACE THE LAST SENTENCE OF SUBCLAUSE 8.2.11 WITH THE FOLLOWING:

"Where measured by number or sum, the rate or sum shall cover the cost of excavation, trimming, backfilling, concrete, formwork, and steel reinforcement (including 80 kg high tensile steel per cubic metre of concrete where the amount of steel is not indicated on the drawings) as well as labour, etc., to complete the thrust block as shown on the drawings in addition to the operations and materials specified in this subclause."

Replace the heading and contents of subclause 8.2.13 with the following:

PSL 8.2.13 Chambers

a) Valve and Meter Chambers, etc. .... Unit: No

REPLACE THE SECOND SENTENCE IN SUBCLAUSE 8.2.13 (a) WHICH STARTS WITH THE WORDS “The rate shall cover …” WITH THE FOLLOWING:

"The rates for valve chambers and other pipeline structures shall cover the costs specified for thrust blocks and for all other necessary materials, such as air vents, access covers and access ladders to complete the chamber as detailed on the drawings, but excluding:

i) reinforcing steel, and

ii) pipe specials (valves and fittings).

The rates shall also cover the costs of providing padlocks to all chambers, opened by the same master key."

b) Extra over for chambers of depth exceeding 1,5m ..... Unit: No

Additional depths of chambers in excess of 1,5m will be measured in increments of 0,5m depth for each type of chamber.

The rate tendered shall cover the cost of the complete construction of each extra 0,5m additional depth as well as for additional step irons as required.

Note:

The Contractor shall note that all pipes, specials and fittings in the various valve chambers along the route of the pipeline have been grouped together in the Bill of Quantities and not separately itemised per Sub-Clauses 8.2.2 and 8.2.3. The payment provisions as specified shall none the less apply as appropriate.”

PSL 8.2.15 Special Wrapping in Corrosive Soil

Delete this subclause. Provision has been made under PSL 8.2.1 for the measurement and payment of work included under this Sub-Clause.

Add the following new Clauses:

PSL 8.2.16* Marker blocks

(a) Installation of valve markers complete as per Drawing .....Unit: number

(b) Installation of pipe markers complete as per Drawing ……...Unit: number

(c) Installation of road crossing markers complete as per Drawing……Unit: number

The tendered rate shall include full compensation for all excavation and backfill, labour, equipment and materials to manufacture and install the blocks as shown on the Drawings.

PSL 8.2.17* ..... Supply and install overflow, scour, inlet and outlet pipes at reservoir (description, diameter, and material type specified) Unit: Number

The rate tendered shall cover the cost of the work provided for under 8.2.1, PSL 8.2.1 and 8.2.4, for the supply and installation of all stainless steel bolts, nuts, washers, insertion pieces, for corrosion protection as specified, and with respect to testing, for the supply and installation of all equipment, fittings and specials required, as well as the cost of water drawn and the disposal of the sterilisation solution. The measured quantity of pipe length will not, except for the payment of materials on site, be measured for payment until the length under consideration has been accepted in terms of subclause 7.3, PSL 7.3.1 and PSL 7.3.3.

PSL 8.2.18* Extra over 8.2.1, PSL 8.2.1 and PSL 8.2.17 for building in of overflow, scour, inlet and outlet pipes at reservoir..... **Unit: Sum**

The rate tendered shall cover the cost of all labour, materials and equipment to build in the overflow, scour, inlet and outlet into the floor of the reservoir."

PSL 8.2.19* Standpipes complete:

(a) (Give description with reference to drawing) .....Unit: number

(b) Etc for other descriptions

The tendered rate shall include full compensation for all excavations for the pipe, for the drain, if required; the base of the concrete pedestal (for the tap); the supply and installation of all pipework and fittings including a 1,2 m long section of the supply pipe measured from the rising pipe; the supply and installation of the taps; backfilling the drain with stone, and the trench with approved backfill material; all formwork and concrete, and; all equipment, labour and diverse material required to complete the standpipe as shown on the Drawings.

PSL 8.2.20* Connection to existing main supply pipe .....Unit: number

The tendered rate shall include full compensation for the cost of excavation, connection to existing 350 mm diameter main supply pipe, removal of surplus material, all labour and equipment necessary to make the connection and all liaison with the local authorities.

PSL 8.2.21* Testing, disinfecting and commissioning of work by Others..... Unit: m
Contractor shall be required to incorporate into his Works length of pipes as shown in the Drawings work done by Others and this rate shall be for the exposing, testing, disinfecting and commissioning as part of his Works pipes done by Others as indicated in the Drawings.

The Contractor shall be responsible for all costs associated with obtaining water for pressure testing of the pipelines. Programming of the testing and commissioning of the scheme should be performed such that once watertightness testing of the reservoirs has been successfully completed, the water inside the reservoirs can be used to test and commission the installed pipelines. No additional provision or payment will be made for water required for testing the pipelines.

PSL 8.2.22* Exposing and repairing work by Others Unit: m

In cases where the testing fails, this item shall be used to compensate the Contractor for exposing and repairing of Work done by others. The rate shall be for labour and plant only. The materials shall be measured under the relevant items in this Specification.

PSL 8.2.23* Supply, Delivery, Installation, Disinfection, Test and commissioning of prefabricated stainless steel Break Pressure Tanks

As per Clause PSL 3.10.6, the Contractor shall supply, deliver, install, disinfection, test and commission prefabricated stainless steel Break Pressure Tanks complete as per drawing 1005270-0000-DRG-CC-614, including galvanised inlet, outlet and overflow pipework, the valves required complete as follows.

(a) LWTS-50-BPT-01 or similar approved for 50mm - 63mm HDPE dia. pipes . Unit: number
(b) LWTS-80-BPT-01 or similar approved for 75mm - 90mm uPVC dia. pipes Unit: number
(c) LWTS-100-BPT-01 or similar approved 90mm - 250mm uPVC dia. pipes Unit: number

The tendered rate shall include full compensation for all the pipes, fittings, valves, disinfecting, watertightness testing and commissioning of BPT. The cost shall also include providing the water required for the watertightness test.

PSL 8.2.24* Extra-over item PSL 8.2.23 for the clearing, excavations, formwork and construction of the BPT bases Unit: Number

The tendered rate shall include full compensation for all excavation and backfill, labour, equipment and materials to construct the reinforced concrete base, 300mm thick, 25/19 MPa.

PSL 8.2.25* Extra-over item PSL 8.2.23 and PSL 8.2.24 for any other items not included above however critical for the installation and functioning of the BPTs Unit: Sum

The tendered rate shall include full compensation for all labour, equipment and materials required for the successful installation of the BPTs as detailed in this Specification however not included in the items above

PSL 8.2.26 Take ownership, lay, bed, test and disinfect pipes complete with couplings: Where allowance has been made for the Contractor to take ownership of material from the Employer, lay, bed, test and disinfect, the tendered rate shall exclude the cost to procure the material, but include all other costs noted in PSL 8.2.1, as well as the costs to take ownership of the material from the Employer, performing

all necessary tests and inspection to ensure the material meets the requirements of the contract specification and transport of the material to the site.

PSLB BEDDING (PIPES)

PSLB 2 INTERPRETATIONS

PSLB 2.3 DEFINITIONS

Flexible pipe

Add the following:

“mPVC, HDPE and steel pipes shall all be classified as flexible pipes.”

PSLB 3 MATERIALS

PSLB 3.1 SELECTED GRANULAR MATERIAL

Replace the contents of Clause 3.1 with the following:

"Selected granular material shall have a PI not exceeding 6 and shall be free from sharp-edged particles exceeding 19 mm."

PSLB 3.2 SELECTED FILL MATERIAL

ADD THE FOLLOWING:
"Selected fill material used for bedding shall be stabilised with 5% cement as specified under Subclause PSDB 3.5(c)."

PSLB 3.3 BEDDING

Add the following:

“For the purposes of this clause mPVC, HDPE and steel pipes shall be classified as flexible pipes.”

Where structures are to be built over pipework, where shown on the drawings, or where ordered by the Employer’s Agent, the bedding cradle specified shall be stabilised with 5% cement as specified under Subclause PSDB 3.5(c)."

PSLB 3.4.1 Suitable material available from trench excavation

Replace the words “(but is not required”) in the fifth line with the words “(at his own cost).”

“PSLB 3.5* BEDDING IN WATERLOGGED CONDITIONS

Where ordered by the Employer’s Agent a bedding cradle of the specified thickness, comprising of 6,7 mm concrete stone complying with SANS 1083, shall be used in waterlogged conditions.”

PSLB 5 CONSTRUCTION

PSLB 5.1.1.2 Bottom

Add the following:

“Where expansive clay is encountered in the trench bottom, the selected fill blanket shall comprise of selected granular material.”

PSLB 5.1.2 Details of bedding

Notwithstanding the provisions of this subclause, pipes shall be bedded and protected in accordance with the details shown on the Drawings, which shall supersede, as applicable, drawings LB 1 through to LB 5.

Add the following paragraph.

"The dimension "X" for flexible and rigid pipes as indicated on drawing LB-1 will be 150 mm unless otherwise indicated on the drawing. The dimension "X" will be measured from the invert of the pipe."

PLSB 5.1.4 Compacting
REPLACE "90%" WITH: "90% (100% for sand)".

PSLB 5.3 PLACING AND COMPACTING OF FLEXIBLE PIPES

Notwithstanding the provisions of this subclause, the bedding for flexible pipes shall be constructed to the dimensions shown on the Drawings and by using the bedding material specified (refer also PSLB 5.1.2).

PSLB 8 MEASUREMENT AND PAYMENT

PSLB 8.1.3 Volume of bedding materials

Notwithstanding the provisions of this subclause, the volume of bedding will be computed from the dimensions shown on the Drawings.

Replace the last sentence with the following:
“No allowance will be made for bulking of material or any additional volume of bedding material required due to over break or any other cause.

Further, the volume of bedding displaced by the pipeline will not be measured for payment."

PSLB 8.1.5 Disposal of displaced material

Replace the contents of this Clause with the following:

"Material displaced by the pipeline and by imported material from sources other than trench excavation, shall be disposed of at an approved site furnished by the Contractor. No haulage shall be payable for such material."

PSLB 8.1.6 Free-haul

Delete the words "of 0,5 km" in the first line of this Clause.

Refer to SANS 1200 D, Subclause 5.2.5 (Transport for earthworks).

PSLB 8.2.2.3 From commercial sources

(c)* 6,7 mm concrete stone to SANS 1083 .....
Unit: m^3

Add the following to the end of this Clause:

"Commercial sources shall include off-site sources located by the Contractor."

PSLB 8.2.5 Overhaul of Material for Bedding … etc.

Delete this subclause

"PLSB 8.2.6* Extra over 8.2.1 and 8.2.2.1 to screen material for:
(a) Selected granular material.....Unit : m^3

(b) Selected fill material .....Unit : m^3

The tendered rate shall cover the cost of supplying all labour, plant and equipment necessary to select and stockpile suitable material, as well as for screening the material to comply with the specifications for the different types of bedding material."
ADD THE FOLLOWING:

"PSLB 8.2.7 Provision of stone/geofabric to deal with water..... Unit: m^3/m^2

If in the opinion of the Employer's Agent, the Contractor complied with the requirements for dealing with water as specified in PSA 8.8.7., the Employer's Agent may instruct the installation of crushed stone and filter fabric. Payment for these items will only be made where instruction was given in writing by the Employer's Agent.

The provision of crushed stone bedding material will be measured by volume based on the specified trench width and a maximum layer thickness of 300 mm unless a greater depth has been specified by the Employer's Agent.

The unit rate shall cover the cost of supplying and laying the crushed stone.

The filter fabric will be measured separately by area based on the specified trench width, a stone bedding thickness of 300 mm and an overlap of 300 mm.

The rate shall cover the cost of the supply, delivery and laying of the filter fabric.

SLE STORMWATER DRAINAGE

PSLE 1 SCOPE

PSLE 1.1 Add the following:

“This specification shall also cove the construction and installation of the subsoil drainage applicable to the reservoir.”

PSLE 3 MATERIALS

PSLE 3.4 MANHOLES, CATCHPITS, AND ACCESSORIES

PSLE 3.4.1 Bricks

ADD THE FOLLOWING:

"Bricks shall be engineering bricks complying with the requirements of SANS 227."

ADD THE FOLLOWING SUBCLAUSE:

"PSLE 3.6* MATERIALS FOR SUBSURFACE DRAINS

(a) Pipes and fittings

Pipes for subsurface drains shall be normal duty, perforated or slotted uPVC pipes complying with SANS 791. Fittings shall be heavy duty and shall also comply with SANS 791.

The size of the perforations in perforated pipes shall in all cases be 8 mm in diameter ± 1,5 mm, and the number of perforations per metre shall not be less than 26 for 100 mm pipes and 52 for 150 mm pipes. Perforations shall be spaced in two rows for 100 mm pipes and in four rows for 150 mm pipes, as shown on the Drawings.

Slotted pipes shall have a slot width of 8 mm with a tolerance of 1,5 mm in width. The arrangement of the slots is subject to the Employer’s Agent's approval, but the total slot area shall not be smaller than that specified for perforations.

(b) Crushed stone

Crushed stone shall be 19 mm single-sized and shall comply with the requirements of SANS 1083.

(c) Geotextiles and Geofabrics

Geotextiles shall be a non-woven, spun or thermic-bonded continuous filament fabric consisting of at least 85% by mass of polypropylene, polyester or other approved material and manufactured for

civil-engineering applications by a recognised manufacturer."

(d) No-fines Concrete

No-fines concrete shall be as specified under Particular Specification PC."

PSLE 5 CONSTRUCTION

Add the following subclauses:

"PSLE 5.8 CONSTRUCTION OF SUBSURFACE DRAINS

After the completion of the blinding and excavations, the bottom portion of the trench and top of blinding 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 excavations 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.

A layer of crushed stone or no-fines concrete of the thickness shown on the Drawings shall be placed on the geotextile and be lightly tamped and finished to the required gradient.

Pipes of the required size shall be firmly bedded on the permeable material, true to level and grade, and coupled where required. The trench shall then be backfilled with crushed stone or no-fines concrete to the height above the pipes and as shown on the Drawings or as directed by the Employer's Agent.

Crushed stone shall be placed in layers of not more than 300 mm at a time. Care shall be taken to prevent the contamination of crushed stone or no-fines concrete during construction of the subsurface drains and all material contaminated by soil or silt shall be removed and replaced by the Contractor at his own expense.

The drain pipes shall be joined by approved couplers. The pipes shall be laid with the perforations at the top or at the bottom, as directed. The higher end of subsurface drain pipes shall be sealed off with a loose concrete cap of class 20/19 concrete, as shown on the Drawings and at the lower end of the pipe shall be built into a manhole wall providing a positive outlet, or it shall be connected to the stormwater pipes or culverts.

Where applicable, after all the crushed stone or no-fines concrete material has been placed, the protruding vertical filter material has been placed, 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. An overlap of at least 200 mm shall be provided between the portions folded back.

The top 20 mm of surface of no-fines concrete under the reservoir shall receive a 1 : 4 Cement : Sand mortar and a power floated finish.

The remainder of the trench shall be immediately backfilled with approved impermeable material preferably obtained from the excavations, in layers not exceeding 150 mm and compacted to 90% of modified AASHTO density, unless otherwise ordered by the Employer's Agent. The trench shall 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 with pipes without perforations or slots shall be backfilled with impermeable backfill material as described above. Suitable excavated material may be used for backfilling.

Payment for excavations as well as for backfilling with impermeable material will be made under SANS 1200 DB.

PSLE 8 MEASUREMENT AND PAYMENT

PSLE 8.2 SCHEDULED ITEMS

PSLE 8.2.1 Supply and lay concrete pipe culverts

Add the following:

"Notwithstanding the stated provisions, bedding will be measured for payment in terms of the appropriate clauses of SANS 1200 LB and PSLB."

PSLE 8.2.8 Supply and installation of manholes, catchpits and the like

Replace the contents of the item with the following:

"Separate items are listed for manholes and catchpits etc. with reference to depths (increments of 1,0 m) and type. The rate shall cover the cost of any excavation in all material (including disposal of surplus) and backfilling with suitable material in accordance with PSLE 5.8 (including importation of material if required) additional to what is measured under the relevant pipe trench item (refer to SANS 1200 DB 8.2.2 and 8.2.3).

The rate shall further cover the cost for building the manholes and catchpits complete as shown on the relevant Drawings.

The depth category of manholes and catchpits shall be measured as the difference between the cover level and the deepest invert level."
Add the following items:

"PSLE 8.2.14 Supply and lay flexible slotted HDPE drainage pipes complete with fittings and couplings on class B bedding (diameter stated) .....
Unit : Number

The payment provisions of 8.2.1 and PSLE 8.2.1 shall apply.

PSLE 8.2.15 Geotextile (description of type, grade, etc).....Unit: m^2
The filter fabric will be measured in place after installation.

The tendered rate shall include full compensation for procuring, supplying, cutting, overlap, jointing,

placing and protecting the filter fabric as specified, as well as for wastage.

PSLE 8.2.16 Crushed stone in subsurface drains: ..... Unit: m^3

The tendered rate shall include full compensation for procuring, supplying, transporting and placing the material as specified. The quantity shall be calculated from the authorised dimensions.

PSLE 8.2.17 Grade 20 MPa/19 mm concrete outlet structures for subsurface drains (including framework) Unit: m^3

The tendered rate shall include full compensation for procuring and supplying of all materials, providing and erecting formwork, reinforcing and mixing, transporting and placing concrete.

PSLE 8.2.18 Concrete caps for subsurface drain pipes Unit: number

The tendered rate shall include full compensation for supplying and installing the concrete caps.

PSLE 8.2.19 Jointing with existing network Unit: sum

The tendered sum shall include full compensation for the cost of all labour, plant, materials, excavation, backfilling, compaction and overheads to join the subsurface drains to the existing stormwater network.

PSLE 8.2.20 Breaking into existing manhole and installing new pipe:

(a) (State pipe diameter and type) Unit: sum
(b) Etc. for other diameters and types

The tendered rates shall include full compensation for the supply of all labour, plant and materials, making an opening in the existing manhole, installing the new pipe in the new opening, sealing around the pipe, breaking out the existing benching and channels where required and reconstructing them complete with rendering to

suite the new pipe arrangement, disposing of all debris to the dumping site and backfilling around the manhole with selected material.

PSLE 8.2.21 Breaking into existing stormwater pipe, installing new pipe and building new manhole:

(a) (State new pipe diameter and type) Unit: number
(b) Etc. for other new pipe diameters and types

The tendered rates shall include full compensation for the supply of all labour, plant and materials, removing a section of the existing stormwater pipe, installing the new pipe, constructing the complete, new manhole, sealing around the pipes, disposing of all debris to the dumping site and backfilling around the manhole.

PC NO-FINES CONCRETE

CONTENTS

PC 01 SCOPE

This is a Particular Specification and covers the manufacture and placing of no-fines concrete used in the Works.

PC 02 MATERIALS

Cement, aggregate and water shall comply with the requirements of SANS 1200 G.

Each size of aggregate shall be a single size aggregate graded in accordance with SANS 1083.

PC 03 CLASSES OF NO-FINES CONCRETE

No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used. Class NF 19 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 concrete shall be as follows:

Class	Aggregate per 50 kg cement
NF 38	0,33 m³
NF 19	0,30 m³
NF 13	0,27 m³

PC 04 BATCHING AND MIXING

Cement shall be measured by mass or in full pockets of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The aggregate shall be moist or wetted before the cement is added. Where drum mixers are used, about 20% of the water shall be poured into the drum before the aggregate and cement are loaded. The mixing time in the drum shall be about 45 to 50 seconds.

The quantity of water added shall be just sufficient to form a smooth grout which will adhere to and completely coat each and every particle of aggregate, and which is just wet enough to ensure that, at points of contact of aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water for every 50 kg of cement.
Mixing shall be done in an approved batch-type mechanical mixer, but small quantities may be hand-mixed.

PC 05 PLACING

No-fines concrete shall be placed in accordance with the procedure approved by the Engineer. It shall be placed in its final position within 15 minutes of having been mixed.

The concrete shall be worked sufficiently to ensure that it will completely fill 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 shall the concrete be vibrated.

PC 06 PROTECTION

All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods:

(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

No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days.

PC 07 MEASUREMENT AND PAYMENT

PC.01 Cast-in-situ no-fines concrete (state class) Unit: m^3

The provisions of subclause 8.1.3 of SANS 1200 G shall apply *mutatis mutandis*.

PART B: MECHANICAL WORKS

PS1: MECHANICAL SPECIFICATIONS

APPLICABLE STANDARDISED SPECIFICATIONS FOR MECHANICAL WORKS

STANDARD SPECIFICATION FOR MECHANICAL WORKS
(INCLUDING GENERAL WORKS)

The following Standard Specifications shall generally apply to all equipment proposed on this Contract. However, there are specific requirements in certain sections of these Documents which pertain to particular items of Mechanical Equipment. These Particular Specifications shall supersede the Standard Specifications.

SERIES M1 GENERAL

M1001	General Mechanical Engineering	Applicable
M1002	Corrosion Protection	Applicable

SERIES M2 OPERATION AND MAINTENANCE AND SAFETY

M2001	Operation and Maintenance	Applicable
M2002	Maintenance Requirements (Section C5)	Applicable

SERIES M3 AUXILIARY MECHANICAL EQUIPMENT

M3001	Mountings	Not Applicable
M3002	Grid Floors, Guard rails and Ladders	Not Applicable
M3003	Waste Skip	Applicable

SERIES M4 FASTENERS

M4001	Nuts, Bolts and Fastening Sets	Applicable

SERIES M5 MEDIUM PRESSURE PIPES

M5001	Generals for Medium Pressure Pipes	Not Applicable

SERIES M6 PUMPS

M6001	Centrifugal Type Pumps	Not Applicable
M6002	Axial Flow Pumps	
M6004	Positive Displacement Type Pumps	Applicable
M6006	Self-Priming Type Pumps	Applicable
M60014	Air Lift Pump	Not Applicable
M60015	Submersible Type Pumps	Applicable

SERIES M7 VALVES

M7001	General Valves	Applicable

M7002	Telescopic Valves	Not Applicable
M7003	Actuators	Not Applicable

SERIES M9 SCREENING

M9001	Mechanically Front Raked Screen	Not Applicable
M9002	Hand Raked Screen	Applicable

SERIES M10 MECHANICAL FLUID CONTROL EQUIPMENT

M10001	Fluid Control Gates and Tank Valves	Not Applicable

SERIES M11 CONVEYORS

M11001	Hydro-Conveyor	Not Applicable
M11002	Shaftless Spiral Screw Conveyor	Not Applicable
M11003	Conveyor Belt	Not Applicable

SERIES M12 SCREW COMPACTOR

M12001	Screw Compactor	Not Applicable

SERIES M14 DISINFECTION AND CHEMICAL DOSING

M14001	Gas Chlorination	Not Applicable

SERIES M15 AERATION

M15004	High Speed Surface Aerator	Not Applicable

SERIES M16 SETTLING TANKS

M16002	Clarifiers	Not Applicable

SERIES M17 MIXERS

M17002	Submersible mixers	Not Applicable

SERIES M20 LIFTING EQUIPMENT

M20001	Overhead Travelling Cranes	Not Applicable
M20002	Crawl Beams and Chain Blocks	Not Applicable
M20003	Davits and Winches	Not Applicable

SERIES M1 GENERAL

SECTION: M10001: GENERAL MECHANICAL ENGINEERING

TABLE OF CONTENTS

SERIES M1 GENERAL

SECTION: M10001 GENERAL MECHANICAL ENGINEERING

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.

2. DESIGN SPECIFICATION

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 Engineer considers such deviation an improvement.

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 Engineer.

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.

Where, in the opinion of the Engineer, an installation is not safe, the Contractor shall remedy such defect at his own cost to the satisfaction of the Engineer.

2.3. Design factors

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, mal-function and, as far as is practical, mal-operation; 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.

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 where no further damage can be done in the event of a failure, malfunction,

mal-operation, overload and, as far as practical, misuse. All reasonable and economically justifiable protections to prevent or limit damage to plant and equipment, particularly in high risk situations, must be incorporated. Protections shall:

- 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.

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.

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

Wearing parts shall be designed for interchangeability and ease of removal and replacement.

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.

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.

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.

3. MATERIALS OF CONSTRUCTION

3.1. Installation

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: 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.

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 Engineer 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.

3.1.3 Materials

3.1.3.1. 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.

3.1.3.2. 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.

3.1.3.3. Plastics

Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application.

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 Engineer 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.

3.1.5 Fabrication of carbon steels

3.1.5.1. Standards

Steelwork shall be constructed, fabricated and erected in accordance with SANS 1200H where applicable.

3.1.5.2. Finish

Weld spatter and other protrusions shall be removed. Sharp edges shall be rounded to a radius of at least 2 mm.

3.1.5.3. 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.

3.1.5.4. Inspections

The Contractor shall arrange for the Engineer to inspect fabrications, including fabricated pipework, in the fabrication workshop and prior to corrosion protection.

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 Engineer to inspect fabrications, including fabricated pipework, in the fabrication workshop.

3.1.7 Welding

General Welding Requirements

Standards**:** Standards complying with good modern practice, and acceptable to the Engineer, 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 Engineer. No crevices will be permitted and where stitch welding has been approved by the Engineer, 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 Engineer.

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.

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 Engineer but should rather be avoided by taking the appropriate measures.

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.

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).

Noise control

3.1.10.1 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.

3.1.10 Bearings

Bearing systems shall be designed to provide safe shut down without damage under normal stoppages as well as electrical supply failure.

3.1.11 Lubrication

3.1.12.1. 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.

Pipework for grease distribution shall be of stainless steel or non-ferrous metal.

3.1.12.2. 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.

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.

SERIES M1 GENERAL

SECTION M1002: GENERAL CORROSION PROTECTION

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SERIES M1 GENERAL

SECTION M1002: STANDARD SPECIFICATION FOR GENERAL CORROSION PROTECTION

1. CORROSION PROTECTION: APPLICATION AND CONTROL

1.1 Painting contractor

Surface preparation and coating application shall be carried out by experienced industrial painting contractors who are fully equipped and staffed to do such work in their own covered premises strictly in accordance with the paint manufacturer's recommendations. Before proceeding with the corrosion protection coatings, the Contractor shall submit the name of the painting sub-contractor for approval by the Engineer.

1.2 Site work

Surface preparation and coating application shall not be done on Site except for minor repairs, for application of the final aesthetic coat, where specifically called for or where permitted by the Engineer in writing.

1.3 Systems to be used

Systems: The corrosion protection systems to be used on the plant and equipment will usually be specified for the equipment, but if not, the Contractor shall recommend a suitable system for approval by the Engineer. If doubt exists as to the system or colour to be used, the Engineer's requirements must be ascertained.

Alternative systems: Alternative systems superior to those specified may be used if approved in writing by the Engineer.

All items to be painted: Except where otherwise specified, all metal surfaces shall be painted. This includes hot-dip galvanized items and metal-sprayed coatings. In the latter case the paint shall be in the form of a sealer. Details of approved painting systems to be used are given below.

Coating appearance: After installation on Site the finished paintwork must be neat, smooth, of uniform colour and to the approval of the Engineer.

316 Stainless steel: It is not usually necessary to paint 316 stainless steel. If corrosion of 316 stainless steel does occur, and depending on the appearance or extent of the problem, the Engineer may call for pickling, electrocleaning, painting or replacement of the item at no additional cost. Painting may however be required if contaminated or stained surfaces cannot be properly cleaned or where stitch welding has been approved.

1.4 Quality control of coating application

Inspection: The Contractor shall arrange for the coating application on fabricated steelwork to be inspected throughout by the Engineer. The Engineer may approve inspections by an independent competent person (hereinafter called the Inspector) appointed by and at the cost of the Contractor.
Inspection report: A written report of the inspections, prepared by the Inspector and signed by both the Inspector and the Contractor, shall be submitted for appraisal by the Engineer before delivery of the equipment to Site.

Inspector qualifications: Inspectors appointed by the Contractor shall hold an appropriate qualification from either the CISA, the SAIW or the SAQCC.

Identification of items: Every item to be coated shall be identified by a welded or hard-stamped code. Records shall be maintained for each item.

2. CORROSION PROTECTION: SURFACE PREPARATION

2.1 Imperfections

Welding shall be free of blowholes and all welding flux removed. All weld spatter, sharp edges and other 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, however, be performed on stainless steel). Areas to be painted shall be free of crevices. If the Engineer has permitted stitch welding, crevices shall be filled with a compatible sealing compound after the priming coat has been applied.

2.2 Abrasive blasting

Before coating all surfaces shall be properly degreased and abrasive blast cleaned to an SA3 finish with a 40-65 µm surface profile to Swedish Standard SIS 055900 of 1967. The abrasive shall comply with paragraph 4.3.3 of SANS 064 and shall be free from all traces of oil, grease, foreign matter and corrosive contaminants such as chlorides, etc. The prepared surface shall be given the first coat of the painting system within 4 hours after cleaning.

In instances where stainless steel and 3CR12 are to be painted, the surface shall be suitably abrasive blasted prior to primer application.

2.3 Between coats

Between coats or with previously painted surfaces in good condition, all traces of oils, greases, soluble salts and corrosive air borne contaminants shall be thoroughly washed from the surface to be painted using a detergent type cleaning agent, rinsed and dried. The previous coat shall then immediately be lightly sanded or otherwise prepared as recommended by the paint manufacturer, wiped clean, dried and painted. Solvents are not acceptable as a surface cleaning agent.

2.4 Hot-dip galvanized surfaces

Hot-dip galvanized surfaces to be painted shall be free from white rust and shall be cleaned with an approved water based galvanizing cleaner using non-metallic abrasive pads until a "water break free" surface is obtained. The surface shall then be thoroughly rinsed with clean potable water to remove all residues and dried immediately prior to painting. Where necessary to obtain adhesion a sweep blast of the surface shall be done after cleaning.

3. CORROSION PROTECTION: METAL COATINGS

3.1 General

Fabrication of items to be protected by metal coatings shall be in accordance with SANS ISO 14713.

3.2 Hot-dip galvanizing

Standard: Hot-dip galvanizing shall be done in accordance with SANS 121 (ISO 1461:1999) Hot-dip Galvanized Coatings on Fabricated Iron and Steel Articles.

Thickness: Coatings shall be to the thicknesses detailed in the Standard.

Passivation: Hot-dip galvanized material which is to remain unpainted shall be passivated as specified in SANS 121. Items to be painted after hot-dip galvanizing shall be air dried and not passivated.

White rust: Hot-dip galvanized material shall be substantially free from white rust when it is erected on site. Stacking and storing shall at all times be done in a manner to prevent white rust forming.

Repair: Damage to hot-dip galvanizing caused by welding, grinding, etc. is not acceptable. The repair to hot-dip galvanizing damaged by handling or transport shall be done by cleaning the area and applying 3 coats of a zinc rich primer giving a dry film thickness of at least 100 µm and containing at least 94 % zinc in the dried film. If the opinion of the Engineer is that damage is excessive, such items will be rejected by the Engineer and shall be replaced by the Contractor at his own expense.

Welding: Welding after hot-dip galvanizing is not acceptable.

Test certificate: The Contractor shall supply a galvanizer's guarantee or test certificate prior to installation.

3.3 Sprayed metal coatings

Standard: Sprayed metal coatings shall be done in accordance with SANS 1391: Standard Specification for Thermally Sprayed Metal Coatings as amended below. The statements below apply to Part 1 of SANS 1391.

Symbols: The type symbol described in Table 1 of the Standard shall be used to specify material and thickness requirements; i.e. AL for aluminium, Zn for zinc, followed by the minimum average thickness in microns.

Thickness: The minimum coating thickness for both Aluminium and Zinc shall be 150 µm.

Thickness testing procedure: The procedure laid down in Clauses 4.2.1.3 a (1) or b (1) of SANS 1391: Part 1 for the determination of the coating thickness shall not be regarded as sufficient. The thickness shall be **checked on every surface plane** at points not more than 300 mm apart for small articles and 500 mm for large articles, e.g. angles shall be checked along all 4 surfaces, channels along all 6 surfaces, pipes in 4 planes etc. The minus tolerance on thickness in isolated areas shall also not exceed -10% and such low areas shall not be larger than 50 mm in diameter.

Period between preparation and coating : For the purpose of Clause 3.3 of SANS 1391: Part 1, the time between preparation and coating shall be shortened from 4 hours to 2 hours at any application area closer than 10 km from the coast.

Sealing: Unless otherwise specified, all metal coatings shall be sealed immediately after metal-spraying using a suitable pre-treatment wash primer followed by coats of low viscosity

sealant until absorption is complete. This shall be followed by a suitable top coat system to give a smooth final finish. The various coatings used shall be as specified or, if not specified, shall be selected by the Contractor to suit the duty and submitted to the Engineer for approval. The final coat shall normally be applied on site after installation. Colours shall be as specified or as agreed with the Engineer. Depending on the particular application, the following systems are acceptable:

System 1

- Application of micaceous oxide pigmented polyamide cured epoxy to achieve a dry film thickness of 60-80 µm; (Sigmarite Sealer, or equivalent);
- One coat of solvent borne modified acrylic coating to achieve a dry film thickness of 70 µm; (Sigma Topacryl coating, or equivalent); and
- One coat of solvent borne modified acrylic finish to a dry film thickness of 30-45 µm; (Sigma Topacryl finish, or equivalent).

System 2

- Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Intergard 269, Chemrite Carboline Rustbond Penetrating Sealer, or equivalent);
- Application of one intermediate coat chemical resistant vinyl copolymer to a minimum dry film thickness of 70 µm; and
- Application of one coat of vinyl copolymer chemical resistant enamel to a minimum dry film thickness of 40 µm.

System 3

- Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Chemrite Carboline Rustbond Penetrating Sealer, Intergard 269, or equivalent); and
- Application of two coats of polyurethane enamel (twin pack) to a minimum combined dry film thickness of 70 µm.

4. CORROSION PROTECTION: PAINT COATINGS

4.1 Paint selection

Paint quality: Paint shall be of best quality, of approved manufacture and brand and comply with the requirements of the relevant SANS or BS specifications.

Compatibility: To avoid incompatibility between paint coats due to variations in formulation, the different coats in any one paint system shall be provided by the same manufacturer.

Confirmation of suitability: Contractors shall obtain confirmation from their paint suppliers that, when using their paints, the systems specified are technically correct and suitable for the application and the material being coated.

4.2 Paint application

Surface preparation: All surfaces shall be properly prepared as specified in Clause "Corrosion Protection: Surface Preparation".

Painting: Paints shall be applied strictly in accordance with the manufacturer's instructions by tradesmen skilled in this class of work. Thinning of paint shall only be allowed for spray application and the manufacturer's recommended thinners shall be used.

Coating of hidden areas: Areas which will be inaccessible after erection and surfaces resting on floors shall receive the full paint system prior to erection. Mating or contact surfaces shall be prepared and primed and be brought together while the paint is still wet.

Items encased in concrete: Metal to be encased in concrete shall be painted externally up to 30 mm inside the concrete section, leaving the remainder bare so as to facilitate bonding with the concrete.

Crevices: Crevices will not be permitted. Where unavoidable crevices are accepted by the Engineer, such crevices shall be filled with a compatible filler after application of the priming coat.

Protection of machined surfaces: Where painting of machined surfaces is not possible or advisable, these surfaces shall be coated with an approved proprietary anti-corrosion compound giving 12 months protection under operating conditions. Shaft ends and machined mating or mounting surfaces or pads shall be so coated and shall not be painted.

Coating thickness: The dry film thickness shall be measured using a non-destructive thickness gauge such as the "Mikrotest" or equivalent and shall comply with the Specification.

Repair: Painted areas damaged during transportation, erection or any means whatever shall be repaired as follows - Rusted spots shall be removed and cleaned by means of a wire brush or emery paper to a bright metal finish and the surrounding paint which is still intact shall be feathered for a distance of 50 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the undamaged area.

Protection on site : Proper and adequate use of cover sheets and other means shall be made to protect the existing paintwork from damage and from metal dust and sparks when welding, grinding, and wire brushing on site. Similarly effective steps shall be taken to prevent spillage or splashing or other damage to floors, walls and equipment when painting on site and any damage or mess caused shall be corrected at the Contractor's cost.

Final coat: The final external coat/s shall always be applied on site after installation except for System A/1, where all coats shall be applied by a specialist applicator at his premises. A professional, smooth finish with a uniform colour is required.

4.3 Final colour code – general

The final colour code shall be as follows:

PIPEWORK				
CONTENTS OF PIPE	**BASIC COLOUR**	**COLOUR OF INDICATOR**		
		1 BAND	**2 BANDS**	**3 BANDS**
AIR				
Compressed, Power	Arctic Blue (F28)		-	-
Aeration	Arctic Blue (F28)	Canary Yellow (C61)	-	-
Instrument	Arctic Blue (F28)	Salmon Pink (A40)	-	-
Vacuum	Arctic Blue (F28)	Primrose (C67)	-	-
Lime Transfer	Arctic Blue (F28)	Crimson (A03)	-	-

PIPEWORK				
CONTENTS OF PIPE	**BASIC COLOUR**	**COLOUR OF INDICATOR**		
		1 BAND	**2 BANDS**	**3 BANDS**
Blower	Arctic Blue (F28)	Verdigris Green (E22)	-	-
CHEMICALS				
Aluminium Sulphate	Jacaranda (F18)	Verdigris Green (E22)	-	-
Sodium Aluminate	Jacaranda (F18)	Crimson (A03)	-	-
Ferric Sulphate	Jacaranda (F18)	Canary Yellow (C61)	-	-
Lime (dry powder)	Jacaranda (F18)	Salmon Pink (A40)	-	-
Activated Carbon	Jacaranda (F18)	Light Stone (C37)	-	-
Polyelectrolyte	Jacaranda (F18)	Cloud White (G80)	-	-
GASSES - (other than air); liquefied or gaseous				
Butane, Propane	Light Stone (C37)	-	-	-
Ammonia	Light Stone (C37)	Ultramarine (F09)	-	-
Blast furnace	Light Stone (C37)	Crimson (A03)	-	-
Carbon Dioxide	Light Stone (C37)	Light Brunswick Green (H07)	-	-
Coke Oven	Light Stone (C37)	Light Grey (G29)	-	-
Producer	Light Stone (C37)	Verdigris Green (E22)	-	-
Chlorine, Hypoclorite	Light Stone (C37)	Canary Yellow (C61)	-	-

WATER				
Cold Drinkable	Brilliant Green (H10)	Cornflower (F29)	-	-
Hot Drinkable	Brilliant Green (H10)	Crimson (A03)	Cornflower (F29)	-
Boiler Feed (Distilled)	Brilliant Green (H10)	Crimson (A03)	Cloud White (G80)	Crimson (A03)
Boiler Feed (De-mineralised)	Brilliant Green (H10)	Cloud White (G80)	-	-
Industrial, Raw	Brilliant Green (H10)	Golden Yellow (B49)	-	-
Reclaimed	Brilliant Green (H10)	Jacaranda (F18)	-	-
Backwash	Brilliant Green (H10)	Light Stone (C37)	-	-
De-sludge	Brilliant Green (H10)	Canary Yellow (C61)	-	-
Stove Circulating	Brilliant Green (H10)	Salmon Pink (A40)	-	-
Hydraulic Power	Brilliant Green (H10)	Terra Cotta (A10)	-	-
Final Treated Effluent	Aquamarine (E67)	-	-	-
Interchange, Stage	Drakensberg Green (H36)	-	-	-
Raw Sewage	Olive Green (H05)	-	-	-
Sea Water	Light Brunswick Green (H07)	-	-	-
Primary Sludge	Dark Brown (B03)	-	-	-
Waste Activated Sludge	Light Brown (B15)	-	-	-
Digested Sludge	Light Brown (B15)	Light Olive Green (H21)	-	-
Pasteurised Sludge	Light Brown (B15)	Cloud White (G80)	-	-
OIL				
Diesel Fuel	Golden Brown (B13)	Cloud White (G80)	-	-
Hydraulic Power	Golden Brown (B13)	Salmon Pink (A40)	-	-
Lubricating	Golden Brown (B13)	Verdigris Green (E22)	-	-
Transformer	Golden Brown (B13)	Crimson (A03)	-	-

PIPEWORK				
CONTENTS OF PIPE	**BASIC COLOUR**	**COLOUR OF INDICATOR**		
		1 BAND	**2 BANDS**	**3 BANDS**
Paraffin	Golden Brown (B13)	Arctic Blue (F28)	-	-

PLANT AND EQUIPMENT	
EQUIPMENT	**COLOUR CODE**
FIRE FIGHTING	
Equipment and Pipework	Signal Red (A11)
ELECTRICAL	
Distribution Boards, Switch-Gear, Terminal Boxes and Conduits	Light Orange (B26)
Emergency Stop	Signal Red (A11)
MACHINE GUARDS	
Inside	Light Orange (B26)
Outside	Colour of Machine
Protruding Shafts, Exposed Gear Wheels and Rotating Parts	Light Orange (B26)
OVERHEAD TRAVELLING CRANE	
Final colour	Golden Yellow (B49)
HANDRAILS	
Horizontal Rails and Chains	Golden Yellow (B49)
Stanchions	Black
Protrusion, Sides of Ramps	Black and Yellow Diagonal Stripes
GENERAL	
Scour Pipes	Deep Buff (B24)
Valves	Basic colour of pipeline
WORKSHOP FLOOR DEMARCATION	
Demarcation Lines	Golden Yellow (B49)
Working Areas	Pastel Grey (G54)
No Parking, No Storage	Golden Yellow (B49)
Aisles and Walkways	Brilliant Green (H10)
Storage Area	Terracotta (A10)
Urethane based paint is to be used for concrete surfaces Traffic paint is to be used for tarred surfaces	

EXCEPTION:

Items made of 316 or 316L stainless steel may be left unpainted provided the surface is of uniform self-colour without blemishes, rust, marks or stains. If blemished the surfaces must either be painted or cleaned by pickling and/or electro-cleaning (not grinding or other mechanical means).

4.4 Painting systems

Definition of terms

The abbreviation "d.f.t." used in this Specification shall mean dry film thickness given in microns and, except where otherwise specified, is the minimum (not average) thickness permissible.

SYSTEM A/1

Three coats of a low solvent, high solids, polyamine/amide cured, epoxy (twin pack) to a minimum thickness of 350 µm.

Notes:

The coating shall undergo holiday detection over the full surface in accordance with SANS 1217. This test shall be done by an inspector holding an appropriate qualification from either the CISA, the SAIW or the SAQCC.

When applied to hot-dip galvanized surfaces, a suitable epoxy primer shall be used after careful surface preparation before applying this system.

This system shall be applied by a specialist applicator prior to delivery to site with particular attention to the required interval between coats.

The first and third coats shall be a different colour to the second coat.

Applied to:

Items subject to immersion and/or wet abrasion; e.g. screw pumps, clarifier rotating arms, scum boxes and weirs, pipework, chutes, tanks, etc.

SYSTEM A/2

System A/1, plus	d.f.t = 350 µm
ash primer to SANS 723	d.f.t = 40 µm
	Total d.f.t = 390 µm

SYSTEM A/3

2 Coats of a micaceous iron oxide pigmented polyamine/amide cured epoxy sealer/coating (twin pack) with d.f.t = 60 µm per coat.

Total d.f.t = 120 µm

Notes:

Use Sigmarite Sealer, or equivalent.
Applied to Hot dry applications up to 200 ºC.

SYSTEM A/4

3 Coats of a micaceous iron oxide pigmented polyamine/amide cured epoxy sealer/coating (twin pack) with a d.f.t = 80 µm per coat. **Total d.f.t = 240 µm**

Notes:

Use Sigmarite Sealer, or equivalent.

Applied to Immersed applications in potable water up to 100 ºC.

SYSTEM A/5

2 or 3 coats polyamine/amide cured coaltar epoxy.	**Total d.f.t. = 400 µm**

Notes:
Where paints are available in different colours, each coat shall be a different colour.

SYSTEM B/1

1 Coat aluminium filled epoxy (twin pack)	d.f.t. = 125 µm
1 Coat polyurethane enamel (twin pack)	d.f.t. = 40 µm
	Total d.f.t. = 165 µm

Application a maintenance coat over weathered coatings on steel.

Notes:

Surface preparation shall include, as a minimum, removal of all loose mill scale, non-adherent rust and loose paint prior to wire brushing and de-greasing and shall be in accordance with an appropriate internationally accepted standard such as the Steel Structures Painting Council of the USA or that of the Swedish Standards Institute's St standards.

SYSTEM B/2

1 Coat HB epoxy primer	d.f.t. = 100 µm
2 Coats polyurethane enamel (twin pack)	d.f.t. = 60 µm
	Total d.f.t. = 160 µm

Applied to motors, gearboxes, cast iron components, steel fabrications, etc.

SYSTEM C/1

1 Coat inorganic zinc silicate	d.f.t. = 75 µm
1 Coat high build modified acrylic coating	d.f.t. = 75 µm
1 Coat modified acrylic finish to approved colour	d.f.t. = 30 µm
	Total d.f.t. = 180 µm

Notes:

The primer must be factory applied. The intermediate and final coats may be applied on Site.

Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat.

The primer shall be tested for full cure before applying the subsequent coats.

This system shall not be used for items subject to immersion.

Intermediate coat shall be Sigma Topacryl, or equivalent.

Top coat shall be Sigma Topacryl Finish, or equivalent.

Applied to heavy fabricated steel items requiring a primer which travels well and/or can be left for an extended period before overcoating.
SYSTEM C/2

1 Coat inorganic zinc silicate	d.f.t. = 75 μm
1 Coat epoxy tie coat	d.f.t. = 75 μm
1 Coat polyurethane enamel (twin pack)	d.f.t. = 40 μm
	Total d.f.t. = 190 μm

Notes:

The complete system must be factory applied and touch ups will be required on Site.

The primer shall be tested for full cure before applying the subsequent coats.

This system shall not be used for items subject to immersion.

Applied to:

Heavy fabricated steel items requiring a hard, high gloss colour finish - e.g. bridges, tanks, non-immersed piping, structural steel, etc.
SYSTEM C/3

1 Coat inorganic zinc silicate	d.f.t = 75 μm
1 Coat modified silicone heat resisting coating suitable for 200 ºC	d.f.t = 75 μm
	Total d.f.t = 150 μm

Notes:

Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat.

The primer must be factory applied.

The primer shall be tested for full cure before applying the subsequent coat.

A tie coat suitable for 200 ºC shall be included between the primer and top coat if so recommended by the paint manufacturer.

The top coat must cure at ambient temperatures.

Applied to:

Steel and cast iron items on dry heat applications with temperatures up to 200 ºC continuous.

SYSTEM C/4

3 coats modified silicon	**Total d.f.t = 120 µm**

Notes:

Steel and cast iron items on dry heat applications with temperatures up to 540 ºC continuous.

SYSTEM D

1 coat epoxy primer (twin pack, for HDG surfaces)	d.f.t = 75 µm
.coat polyurethane enamel (twin pack)	d.f.t = 50 µm
	Total d.f.t. = 125 µm

Applied to:

Hot-dip galvanized steel pipes, handrails and stanchions, guards, steelwork, etc.

SYSTEM E/1

1 coat wash primer to SANS 723	d.f.t = 10 µm
1 coat zinc chromate primer to SANS 679 Type 1	d.f.t = 40 µm
1 coat universal undercoat to SANS 681	d.f.t = 35 µm
2 coats silicone urethane gloss enamel top coat to colour code.	d.f.t = 70 µm
	Total d.f.t = 155 µm

Notes:

If the specified dry film thickness of the zinc chromate primer of 40 μm is not achieved with one coat, an additional coat shall be applied.

The paints used shall be suitable for internal and external use.

An alternative priming and undercoat system of superior corrosion resistance may be used.

SYSTEM E/2

1 Coat phenolic based primer	d.f.t = 20 μm
1 Coat universal undercoat to SANS 681	d.f.t = 35 μm
2 Coats machinery enamel	d.f.t = 50 μm
	Total d.f.t = 105 μm

Notes:

The paints shall be suitable for internal and external use.

The paints selected shall not be damaged by oil spillage or grease and shall be reasonably chemical resistant.

SYSTEM E/3

1 coat zinc chromate self-etching wash primer to SANS 723 max	d.f.t = 10 μm
1 coat zinc chromate primer to SANS 679 Type 1	d.f.t = 40 μm
1 coat universal undercoat to SANS 681	d.f.t = 35 μm
2 coats single pack urethane gloss enamel	d.f.t = 60 μm
	Total d.f.t = 145 μm

Notes:

All paints shall be suitable for internal and external use.

If the specified dry film thickness of the zinc chromate primer of 40 μm is not achieved with one coat, an additional coat shall be applied.

SYSTEM E/4

1 Coat water borne vinyl based primer; Dulux Corrocote 3 or equiv.	d.f.t = 40 μm
2 Coats Acrylic Semi Gloss top coats; Ameron 234 or equivalent	d.f.t = 100 μm
	Total d.f.t = 140 μm

Applied to:

General use on hot-dip galvanized surfaces.

SYSTEM E/5

1 Coat twin pack epoxy zinc chromate primer	d.f.t = 30 μm
2 Coats acrylic semi gloss coats; Amercoat 234 or equal approved	d.f.t = 100 μm
	Total d.f.t= 130 μm

SYSTEM E/6

1 Coat epoxy strontium chromate primer	d.f.t = 25 μm
2 Coats Dulux Silthane Gloss enamel	d.f.t = 60 μm
	Total d.f.t = 85 μm

Note:

The paints used for this system must be suitable for a continuous operating temperature of 120ºC or higher.

SYSTEM F

1 Coat vinyl copolymer polyester	**Total d.f.t = 100 μm**

Applied to steel floor grating.

SYSTEM - FUSION BONDED EPOXY

This is a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating in accordance with SANS 1217. The material used shall be of Type 2; i.e. a thermosetting powder-coating material. The finished coating shall have a thickness of 300 μm and no reading shall be less than 200 μm.

Note:

The Contractor shall execute holiday detection over the full surface in accordance with SANS 1217.

The items to be coated shall be prepared in accordance with Clause 4.1.1 of the SANS 1217 and, in particular, shall have edges ground to a radius of curvature of at least 3 mm.

The surfaces to be coated shall be prepared in accordance with Clause 4.1.2 of SANS 1217 and, in particular, shall be blasted to a preparation grade of Sa 3.

Pre-heating is needed to achieve the required coating thickness.

Applied to immersed objects, cast iron valve bodies, pipe work, etc.

SYSTEM – HOT-APPLIED THERMOPLASTIC

This is a synthetic thermoplastic polyamide, Rilsan or equivalent, which shall be applied by dipping the hot object into a fluidised bed of the polymer. The coating shall be executed in accordance with the supplier's recommendations. The finished coating shall have a thickness of 300 μm and no reading shall be less than 200 μm.

SERIES M2 OPERATION, MAINTENANCE AND SAFETY

SECTION M2001 OPERATION AND MAINTENANCE MANUALS

TABLE OF CONTENTS

SERIES M2 OPERATION, MAINTENANCE AND SAFETY

SECTION M2001 OPERATION AND MAINTENANCE MANUALS

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.

2. GENERAL

The contractor must submit one full set of provisional Operation and Maintenance manuals to the engineer 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 engineer once the manuals have received final approval. The engineer will thereafter distribute these final manuals to Client accordingly.

3. LAYOUT OF THE MANUALS

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;
- Contractors 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.

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.

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;
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.

4. OPERATION AND MAINTENANCE

The following procedures, operational philosophies and functions of the equipment shall be provided:

1. For all equipment, the startup procedures shall be described including pre-start checks. This includes for equipment that automatically starts.
2. Shut down procedures for all equipment is to be described.
3. The operational time for each piece of equipment supplied shall be detailed.
4. The maintenance schedule, regularity of maintenance along with the time intervals between maintenance periods shall be clearly stated.
5. The checking of lubricant and coolant levels along with adjustment of machines shall be clearly described.
6. Standard inspections, services and adjustments shall be described clearly along with time intervals of when these procedures are to occur.
7. Major inspections, services and adjustments shall be described clearly along with time intervals of when these procedures are to occur.

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 engineer has approved and received the final documents along with the relevant plant drawings.

SERIES M2 OPERATION, MAINTENANCE AND SAFETY

SECTION M2002 MAINTENANCE REQUIREMENTS (SECTION C5)

C5. MECHANICAL AND MAINTENANCE (ENGINEERING) SPECIFICATIONS

H. MAINTENANCE REQUIREMENTS

H.1 Requirements

1. A 6-month Operation Service Period, which shall include only the maintenance under an Operation and Maintenance Plan for the centrifuge system, shall be included as part of the Operation Service under this Contract. The Employer shall provide all resources required for operation of the Works, while the Contractor shall be responsible for all routine and preventative maintenance.

2. The Operation Service Period of the contract will commence immediately after the Design-Build Period of the Contract.

3. The maintenance part of the contract shall be in accordance with the Schedule of Prices, and no adjustment of rates shall apply.

4. The pricing of maintenance shall be an all-inclusive monthly amount, based on a schedule of items included in this document. If no schedule of items is included in this document, the Employer's Representative shall supply one. Individual rates for the items will be added up to an all-inclusive monthly amount shown separately for each month.

5. In order to ensure compliance and efficiency, a penalty / bonus system will be applied for various activities. This will be based on a points system and when a designated number of negative points are scored during any month, a penalty will be applied and an amount will be deducted from the monthly payment. Should a designated number of positive points be scored, bonus points will be accumulated. The monetary value of accumulated bonus points will not be paid out during the contract but at the completion of the contract. Under no circumstances shall the penalty points for a month be subtracted from accumulated bonus points.

6. The Contractor will be required to qualify for a Commissioning Certificate prior to commencement of the Operation Service Period. This is to ensure that the works are received in good working order with no defects prior to commencement of the Operation Service Period.

7. The scope of the maintenance requires the Contractor to:

    - Provide routine and preventative maintenance strictly in accordance with the relevant operating and maintenance manuals and keep in good working order all the works, plant and equipment supplied installed and commissioned under Design-Build.

    - Keep full records of routine and preventative maintenance performed on all the equipment individually, in a maintenance database, a hard copy of which must be appended to the manufacturers O & M Manuals.

- Keep all records of adjustments made to equipment.
- Take full responsibility for the maintenance of the works supplied, installed and commissioned under “Design-Build” to ensure continuous operation and functionality twenty four (24) hours per day seven (7) days a week.
- Submit monthly reports and attend all meetings which may be convened by the Engineer and /or Employer on an ad-hoc basis
- Maintenance schedules must be submitted to the Engineer and Employer for approval within 14 days of commencement of the Contract.

9. The above list may not be complete.

10. The Employer’s Representative will administer the contract on behalf of the Municipality and the Engineer will act as the Employer’s Representative for the duration of the Operation Service Period.

A provisional sum has been allowed for in the Schedules of Quantities to cover the costs of this service for a 6 months period. The costs will be deducted monthly from the Contractor’s payment certificates, and payment will be made directly to the Engineer.

H2 Penalty System

H2.1. General

The provisions of this Clause deal with the right to reduce payment due to the Contractor as a result of his (the Contractor's) failure to comply with the provisions of the contract documentation, and/or his lack of diligence in the execution of any work, activity, duty or obligation in terms of the contract and/or his failure to or execute any instruction given by the Engineer or the Employer in terms of this contract. The stipulation of this clause shall not in any way be construed as negating or limiting any other remedy that the Employer may have in terms of the contract documentation.

For the purposes of this clause, term "reduced" or "reduction" or "deducted" when used in the context of any payment due to the Contractor means the reduction of payment due to the Contractor in terms of the payment certificate applicable to the period in which the non-compliance incident(s) occurred.

All money amounts stipulated below shall be subject to non-compliance incident(s) during the Three (3) year maintenance period.

H2.2. Non-Compliance

A non-compliance incident is any one or more of the following which arises or occurs as a result of the Contractor's (or any of his site employees) action or lack of action or non-compliance with the provisions of the contract documentation:

H.2.2.1 Endangerment to the safety of the Employer's or user's personnel and vehicles, the Contractor's site employees and the public. (penalty points = 6)

H.2.2.2 Failure to implement any instruction given by the Engineer within the period prescribed by such instruction or the contract documentation (as applicable). (penalty points = 4)

H.2.2.3 Unauthorised removal from the site of any plant and equipment and record originals. (Penalty points = 4)

H.2.2.4 Inaccurate and/or record keeping or failure to submit monthly records. (Penalty points = 3)

H.2.2.5 Failure to advise the Engineer and/or employer of any impending equipment breakdowns identified during routine maintenance work. (Penalty points = 3)

H2.2.6 The non-compliances stated in H2.2.1 to H2.2.5 above will attract the penalty points indicated in brackets.

H.2.2.6 The following table indicates the penalty point allocation which will be applied to any callout made by the Employer or the Engineer. An emergency call out requires urgent attention and the Contractor will be informed whether a call out is an emergency or not.

Reaction Time	Penalty points			
Hours	Normal	Emergency	TOTALS	
2h or less	0	0		
4 hr to 5h 59min	0	3		
6hrs to 7h 59 min	1.5	6		
8hrs to 9h 59min	3	9		
10hrs to 11h 59min	4.5	12		
12hrs to 13h 59min	6	15		
14hrs to 15h 59min	7.5	18		
16hrs to 17h 59min	9	20		
18hrs to 19h 59min	10	23		
20hrs to 20h 59min	11.5	26		
22hrs to 23h 59min	13	30		
Greater than 24hrs	15	40		

NOTE : Each point is worth R500

SERIES M3 AUXILIARY MECHANICAL EQUIPMENT

SECTION M3003: WASTE SKIP

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SERIES M3 AUXILIARY MECHANICAL EQUIPMENT

SECTION M3003: WASTE SKIP

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 a waste skip.

2. DESIGN SPECIFICATIONS

2.1 General

The waste skip is to have a capacity of 3 cubic meters and must have provision in its design to be able handled and transported by a skip loader vehicle.

3. MATERIALS OF CONSTRUCTION

3.1 Waste Skip

The waste skip is to be fabricated from mild steel plate. The floor is to be 4 mm thick and the sides are to be 3 mm thick. Suitable sized lifting lugs are to be provided, two on each side of the waste skip from which a skip loader vehicle would be able to safely and securely lift the unit under full load. The waste skip is to be reinforced on all corners and on its side. Drainage holes are to be provided for the release of any fluids that may accumulate in the item. Two channel iron frames is to be welded to the underside of the unit so that the base of the container underside clears the ground or bogey on which it is mounted.

3.2 Corrosion protection

Corrosion protection shall be carried out in accordance with the requirements of the General Corrosion Protection Specification: -

Mild Steel : System – Fusion Bonded Epoxy 250 microns minimum.

Colour : Golden Yellow (B49)

4. TESTING AND COMMISSIONING

4.1 Works testing

The waste skip is to be able to be loaded and off loaded by a skip loader vehicle and be transported safely and securely under full load conditions.
Checks on all equipment will be conducted for correct operation and functioning during the defects liability period at 1 month, 6 months and 12 months after final plant take-over.

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 accordance with the original equipment manufacturer’s recommendations

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M4 FASTENERS

SECTION M4001: NUTS, BOLTS, AND FASTENING SETS

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SERIES M4 FASTENERS

SECTION M4001: NUTS, BOLTS, AND FASTENING SETS

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.

2. DESIGN SPECIFICATIONS

2.1 Fasteners general

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 Engineer's written consent.

2.1.2 Fasteners M12 and smaller

All fasteners M12 and smaller shall be manufactured of grade 316 stainless steel.

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.

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.

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.

2.1.1 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.

2.1.6 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.

2.1.7 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.

2.1.8 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.

2.1.9 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 Engineer, the recessed heads shall be filled with a suitable non-hardening sealing compound.

2.2 Anchor fasteners

2.2.1 Type and material

All anchor fasteners shall be of grade 316 stainless steel.

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.

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.

2.2.3 Alternative anchor bolts

The use of 316 stainless steel "Hilti Kwik Bolt" stud bolts or similar may be used as an alternative where approved by the Engineer. 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.

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.

2.2.5 Anti-seize compound

All threads shall be coated with an approved nickel-based, anti-seize/corrosion protection compound before assembly.

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.”

SERIES M6 PUMPS

SECTION M6001 : CENTRIFUGAL TYPE PUMPS

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SERIES M6 PUMPS

SECTION M6001 : CENTRIFUGAL TYPE PUMPS

1. SCOPE

This specification covers the design, supply, delivery, transport, handling, storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period for centrifugal type pumps.

2. DESIGN SPECIFICATION

2.1 Description

All centrifugal pumpsets shall be designed and supplied in accordance with ISO 9908 – Technical specification for centrifugal pumps - Class III. The Manufacturer / Supplier shall review the rated (guarantee) duties and offer his best technical and financial solution at the highest operational efficiency for each station, based on the type (i.e. end-suction, multistage or horizontal split casing), size and arrangement of pumpsets proposed.

Although all pumps shall be installed within an enclosed installation they must be designed and supplied such that they are able to operate under normal Southern African outdoor environmental conditions. The Supplier/Manufacturer shall specify and offer the recommended shaft sealing arrangement, either gland packing or mechanical seal as they deem to be suitable under the operating conditions specified.

All pumpset flanges shall as a minimum be pressure rated and drilled in accordance with SANS 1123 Table 1600/3. Should the casing design pressure exceed this pressure rating then the flange drilling requirements shall be upgraded accordingly.

The prime mover for all pumpsets shall be an electrical induction motor driven via a suitably rated flexible coupling. The operating speed of all pumps should preferably be less that 1500 rpm but must not exceed 3000 rpm.

Tenders will be assessed on the best technical and financial value offered. In adjudicating the tenders, in addition to price, account will be taken of:

- Rated (guarantee) operating efficiency offered to be specified in the data sheets to be submitted with this tender;
- Equipment offered;
- Delivery period;
- Ease of operation and maintenance;
- Technical resources and previous project experience;
- General soundness and robustness of design;
- Reliability of components;
- Availability of spares and after sales service; and
- Any special conditions or qualifications put forward by the Tenderer.

The following National and International Specifications shall be applicable:

ISO 9905:1994	Technical specifications for centrifugal pumps – Class I
ISO 5199:2002	Technical specifications for centrifugal pumps – Class II
ISO 9908:1993	Technical specifications for centrifugal pumps – Class III
ISO 76:1987	Rolling bearings – Static load ratings
ISO 281:1990	Rolling bearings – Dynamic load ratings and rating life
ISO 2372:1974	Mechanical vibration of machines with operating speeds from 10 to 200 rev/s – Basis for specifying evaluation standards
ISO 3069:1974	End suction centrifugal pumps – Dimensions of cavities for mechanical seals and for soft packing
SANS 1123:2000	Pipe Flanges
ISO 7005-1:1992	Metallic flanges – Part 1: Steel flanges
ISO 7005-2:1988	Metallic flanges – Part 2: Cast Iron
ISO 7005-3:1988	Metallic flanges – Part 1: Copper alloy and composite flanges
ISO 1940-1:2003	Mechanical vibration -- Balance quality requirements for rotors in a constant (rigid) state -- Part 1: Specification and verification of balance tolerances
ISO 9906	Rotordynamic pumps – Hydraulic performance acceptance tests – Grades 1 and 2 *(ISO 9906 replaces ISO 3555 and ISO 2548)
*ISO 3555:1977	Centrifugal, mixed flow and axial flow pumps – Code for acceptance tests – Class B
*ISO 2548:1973	Centrifugal, mixed flow and axial flow pumps – Code for acceptance tests – Class C

3. MATERIALS OF CONSTRUCTION

3.1 Materials

Materials						
Medium	**Raw Water (option 1)**	**Raw Water (option 2)**	**Potable Water (option 1)**	**Potable Water (option 2)**	**Sea Water (option 1)**	**Sea Water (option 2)**
Volute casing	S.G. Iron	S.G. Iron	TBA	TBA	TBA	TBA
Casing wear ring	S.G. Iron	S.G. Iron	TBA	TBA	TBA	TBA
Impeller	Aluminium bronze	Stainless steel	TBA	TBA	TBA	TBA
Impeller wear rings	Aluminium bronze	Stainless steel	TBA	TBA	TBA	TBA
Pump shaft	High tensile steel	High tensile steel	TBA	TBA	TBA	TBA
Shaft protecting sleeve	High tensile steel	High tensile steel	TBA	TBA	TBA	TBA

3.2 Corrosion protection

Corrosion protection is to be advised. Contractor is to selects most appropriate corrosion protection technology when determining cost.

4. TESTING AND COMMISSIONING

4.1 Factory acceptance tests

A hydrostatic test shall be performed for pressure-containing parts of a pump at a test pressure of at least 1.5 times the basic design pressure. This pressure shall be maintained for a period of at least 10 minutes.

The Purchaser or his representative shall be entitled to witness the pressure tests (as required and indicated on the data sheets provided with this tender) and at least two (2) weeks notice shall be provided before such testing takes place. A test certificate shall be issued after the successful completion of such tests, in an approved format.

Each pump shall be subject to a hydraulic performance and NPSH test in accordance with ISO 9906, Class I or II, at an approved test facility. The Purchaser or his representative shall reserve the right to witness all tests (as required and indicated on the data sheets provided with this tender) and shall be granted full and complete access to all test data taken during the course of the test. They shall furthermore, be provided with copies of all test sheets, calibration certificates etc. upon completion of the tests. At least two (2) weeks notice shall be provided before such tests are undertaken.

Where pumps are supplied as complete pumpsets, these shall preferably be tested as such and shall be complete with own job motors.

It should be particularly noted that all test data and performance curves produced shall be presented in the units as described in the variation above.

In addition to the test point required to establish the guaranteed performance, a sufficient number of test points shall be measured so as to establish the shape of the full performance curve as presented in the Tender.

During the execution of the performance test, the mechanical operation of the pump shall be monitored with particular reference to abnormal temperature, noise, vibration and leaks.
Failure to achieve the rated (guarantee) point may render the equipment liable for rejection. Should this occur the manufacturer/supplier shall then be responsible to rectify the equipment to achieve such guarantees at own expense.

4.2 Site acceptance tests

Each pumpset shall be subject to a mechanical commissioning run to ensure that it is operating in accordance with its intended design duty and that there is no undue noise, vibration or excessive heating of the units.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

Measurement of payment will be for the unit supplied including all ancillary equipment and accessories as specified.

The tendered rate shall include for design, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

Measurement of payment will be for the unit supplied including all ancillary equipment and accessories as specified.

The tendered rate shall include for the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, in complete working order.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

VARIATIONS AND OR ADDITIONS TO ISO 9908: FIRST EDITION 1993-11-01: TECHNICAL SPECIFICATIONS FOR CENTRIFUGAL PUMPS – CLASS III

3. Definitions

3.1 Rated conditions

Add to the Sub-Clause :

The rated (guarantee) conditions for all pumpsets pertaining to this tender are itemised and described in the Project Specification: Portion 1. These are furthermore outlined in the datasheets to be completed per pumpset to be submitted with this tender.

The pump selected shall be sized such that the rated (guarantee) duty is positioned as close as possible to the Best Efficiency Point (BEP) of the pumps hydraulic and shall be capable of at least 125% of the rated duty flow. The rated (guarantee) duty flow must be pitched no less than 60% and no greater that 110 % of the BEP flow.

4. Design

4.1 General

4.1.1 Characteristic Curve

Add to the Sub-Clause:

The pumps are to be selected so as to have stable, non-overloading characteristic curves.

Pump characteristic curves shall show head, efficiency, power demand and NPSH required, plotted against discharge flow rate in metric units at the rated impeller diameter and speed required to satisfy the rated (guarantee) duty.

Measurement	Preferred Unit	Symbol
Differential head	Meters	(m)
Discharge flow	Litres per second	(l/s)
Efficiency	Percent	(%)
Power absorbed	Kilowatt	(kW)
NPSHr	Meters	(m)
Impeller diameter	Millimeters	(mm)
Speed	Revolutions per minute	(rpm)

The performance curves shall indicate pump performance characteristics at maximum, minimum and rated impeller diameters.

Where two or more pumps are required to operate in parallel, care shall be taken to ensure that one pump can operate in isolation on the system without risk of damage to the pump itself or system within which it operates. This operating point shall be referred to as the “runout duty point’. Details of the hydraulic performances expected under these conditions shall be verified by superimposing the rated characteristics curve of the pumps offered onto the system curve (where) provided. This graphical data as well the runout hydraulic conditions to be specified on the data sheets provided, shall be submitted with this tender.

4.1.2 Net positive suction head (NPSH)

Delete the Sub-Clause and substitute:

The NPSHR shall be based on coldwater as specified in ISO 2548 and ISO 3555. The NPSHA must exceed NPSHR by a margin of at least 30% or 0.5 m, whichever is the greatest, at the rated (guarantee) point specified. The basis for use in performance curves is that NPSH corresponding to a drop of 3% of the total head of the first stage of the pump (NPSH3).

Where a pump may be subjected to operating under a runout duty point condition, the NPSHA must exceed NPSHR by a margin of at least 15% under this scenario.

4.2 Prime movers

4.2.1 Defined operating conditions

Delete the Sub-Clause and substitute:

The prime movers power output rating shall equal or exceed at least the following margins according to the pump's absorbed power demand at the rated (guarantee) point.

Margin	Description	Value
50%	For pumps requiring up to	2 kW
40%	For pumps requiring from	2 to 5 kW
30%	For pumps requiring from	5 to 10 kW
20%	For pumps requiring from	10 to 30 kW
15%	For pumps requiring from	30 to 100 kW
10%	For pumps requiring	Over 100 kW

Where a unit may be subjected to operating at a run-out duty point condition, the power output rating of the prime mover shall be at least 5% greater than the power absorbed by the pump at this point.

4.3 Critical speed, balance and vibration

4.3.2 Balance and vibration

Add to the Sub-Clause:

Rotating elements shall be statically and dynamically balanced according to ISO 1940-1:2003 to a balance quality grade of G2.5. Balancing certificates shall be submitted where specified, in an approved format.

A flat surface measuring at least 25 mm in diameter must be provided at both DE and NDE bearing housings in the horizontal and vertical planes such that a probe from a portable vibrometer may be positioned so as to measure resultant vibration amplitudes.

Failure to achieve the vibration limits specified may render the equipment liable for rejection. The Contractor shall be responsible to rectify the equipment to achieve the specified limits at his own expense.

4.4.4 Mechanical features

4.4.4.1 Dismantling

Add to the Sub-Clause:

The manufacturer/supplier must include for and indicate in their offer any special tools required for operation and or maintenance of the pumping units.

4.6 Forces and moments

Delete the Sub-Clause and substitute:

The manufacturer/supplier shall provide details of allowable external forces and moments on branches in the data sheets to be submitted with this tender.

4.7 Branch (nozzle) flanges

Delete the Sub-Clause and substitute:

Flanges shall be designed and drilled in accordance with SANS 1123. The rated pressure of the flanges shall be as stated in the data sheets

4.8 Impellers

4.8.1 Impeller design

Add to the Sub-Clause:

The rated impeller diameter shall not exceed 95% of full diameter. Similarly the rated impeller diameter shall not be less than 105% of the minimum diameter.

Pumps that are required to handle raw sewage or similar medium shall be capable of passing solids corresponding to an 80 mm diameter sphere as well as rags, paper and other stringy material without clogging.

4.12 Shaft Sealing

4.12.1 General

Add to the Sub-Clause:

The preference for either packed glands or mechanical seals shall be specified in the data sheets. If no preference is stated the supplier shall provide his standard design arrangement or alternatively advise otherwise.

4.13 Nameplate

Delete the Sub-Clause and substitute:

Nameplates shall be securely attached to the pump.

The minimum information required on the nameplate shall be name (or trademark) and address of the manufacturer or supplier, identification number of the pump (for example, serial number or product number), model type and size, rated (guarantee) flow, rated (guarantee) head, rated speed and actual impeller diameter.

4.16 Baseplates for horizontal pumps

4.16.1 General

Add to the Sub-Clause:

Baseplates are to be rigidly designed such that the combined unit (uncoupled pump, motor and baseplate) may be transported as a single item without any excess deflections or strains applied to any of these items. Suitable lifting lugs shall be provided on the baseplate design for transportation and lifting purposes. Lifting of the combined unit must not be carried out by slinging from the pump or motor.

Baseplates shall be supplied complete with holding-down bolts and sufficient steel packers to allow shimming for alignment and grouting. All shims are to be neatly cut so as not to protrude beyond the baseplate or motor‘s base/feet.

acking bolts shall be included in the baseplate design to aid in the alignment of rotating equipment.

4.16.2 Assembly of pump and driver on baseplate

Add to the Sub-Clause:

Pre-alignment of the pump and motor shall be carried out before transporting the combined unit to site. The alignment of these items shall be checked again after final installation and before the coupling and commissioning of the pump and motor sets are undertaken.

6. Shop inspection and tests

Delete the Sub-Clause and substitute:

A hydrostatic test shall be performed for pressure-containing parts of a pump at a test pressure of at least 1.5 times the basic design pressure. This pressure shall be maintained for a period of at least 10 minutes.

The Purchaser or his representative shall be entitled to witness the pressure tests (as required and indicated on the data sheets provided with this tender) and at least two (2) weeks notice shall be provided before such testing takes place. A test certificate shall be issued after the successful completion of such tests, in an approved format.
Each pump shall be subject to a hydraulic performance and NPSH test in accordance with ISO 9906, Class I or II, at an approved test facility. The Purchaser or his representative shall reserve the right to witness all tests (as required and indicated on the data sheets provided with this tender) and shall be granted full and complete access to all test data taken during the course of the test. They shall furthermore, be provided with copies of all test sheets, calibration certificates etc. upon completion of the tests. At least two (2) weeks notice shall be provided before such tests are undertaken.

Where pumps are supplied as complete pumpsets, these shall preferably be tested as such and shall be complete with own job motors.

It should be particularly noted that all test data and performance curves produced shall be presented in the units as described in the variation to Clause 4.1.1 above.

In addition to the test point required to establish the guaranteed performance, a sufficient number of test points shall be measured so as to establish the shape of the full performance curve as presented in the Tender.

During the execution of the performance test, the mechanical operation of the pump shall be monitored with particular reference to abnormal temperature, noise, vibration and leaks.

Failure to achieve the rated (guarantee) point may render the equipment liable for rejection. Should this occur the manufacturer/supplier shall then be responsible to rectify the equipment to achieve such guarantees at own expense.

7. Preparation for dispatch

7.2 Securing of rotating parts for transport

Add to the Sub-Clause:

The combined pump and motor set shall be transported uncoupled.

Annex A: Centrifugal pump – Data sheet

Add to the Sub-Clause:

The Centrifugal pump – Data sheets to be completed and submitted with this tender are presented with the Returnable Schedules.

Annex B: Enquiry, proposal and purchase order

B.1.1 Proposal

Add to the Sub-Clause:

The proposal shall include at least the following technical information:

- List of all deviations to the pump specifications;
- centrifugal pump data sheet completed in full;
- preliminary outline drawing with installation information;
- typical cross-section drawing or exploded view;
- pump characteristic curve;
- Superimposition of pump and system characteristic curves;
- List of special dismantling considerations and or tools required for operation and maintenance procedures.

A full list of documents (to be submitted both with the proposal as well as after contract award) is presented in the list of Returnable Documents.

SERIES M6 PUMPS

SECTION M6015: SUBMERSIBLE TYPE PUMPS

1. SCOPE

This specification covers the design, supply, delivery, transport, handling, storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Defects Liability Period for Submersible type pumps.

2. DESIGN SPECIFICATION

2.1 Description

All submersible pumps shall be designed and supplied in accordance with ISO 9001– Technical specification for submersible pumps. The Manufacturer / Supplier shall review the rated (guarantee) duties and offer his best technical and financial solution at the highest operational efficiency based on the type for pumping raw effluent.

The pump shall be water pressure –tight encapsulated flood proof motors in standard version with option of jacket for cooling system. The pump shall be suitable for dry and wet installations. The pump shall be fitted with a Vortex impellor with case hardened edges. The pump shall be manufactured in such a way that will enable the adjustment of the bowl towards the impellor to maintain maximum efficiency at all times.

The flow and pressure requirements must be calculated in accordance with the Technical Data Sheets. Where the Technical Data Sheets refer to a Contractor design, the flow and pressure is to be provided.

The operating speed of all pumps should preferably be less that 1500 rpm but must not exceed 3000 rpm.

Tenders will be assessed on the best technical and financial value offered. In adjudicating the tenders, in addition to price, account will be taken of:

- Rated (guarantee) operating efficiency offered to be specified in the data sheets to be submitted with this tender;
- Equipment offered;
- Delivery period;
- Ease of operation and maintenance;
- Technical resources and previous project experience;
- General soundness and robustness of design;
- Reliability of components;
- Availability of spares and after sales service; and
- Any special conditions or qualifications put forward by the Tenderer.

2.2. Materials of Construction

2.2.1 Materials

Materials						
Medium	Raw Water (option 1)	Raw Water (option 2)	Potable Water (option 1)	Potable Water (option 2)	Sea Water (option 1)	Sea Water (option 2)
Volute casing	S.G. Iron	S.G. Iron	TBA	TBA	TBA	TBA
Casing wear ring	S.G. Iron	S.G. Iron	TBA	TBA	TBA	TBA
Impeller	Aluminium bronze	Stainless steel	TBA	TBA	TBA	TBA
Impeller wear rings	Aluminium bronze	Stainless steel	TBA	TBA	TBA	TBA
Pump shaft	High tensile steel	High tensile steel	TBA	TBA	TBA	TBA
Shaft protecting sleeve	High tensile steel	High tensile steel	TBA	TBA	TBA	TBA

2.2.2 *Corrosion protection*

Corrosion protection is to be advised. Contractor is to selects most appropriate corrosion protection technology when determining cost.

3. TESTING AND COMMISSIONING

3.1 Factory acceptance tests

A hydrostatic test shall be performed for pressure-containing parts of a pump at a test pressure of at least 1.5 times the basic design pressure. This pressure shall be maintained for a period of at least 10 minutes.

The Purchaser or his representative shall be entitled to witness the pressure tests (as required and indicated on the data sheets provided with this tender) and at least two (2) weeks notice shall be provided before such testing takes place. A test certificate shall be issued after the successful completion of such tests, in an approved format.

The Purchaser or his representative shall reserve the right to witness all tests (as required and indicated on the data, if given ,sheets provided with this tender) and shall be granted full and complete access to all test data taken during the course of the test. They shall

furthermore, be provided with copies of all test sheets, calibration certificates etc. upon completion of the tests. At least two (2) weeks notice shall be provided before such tests are undertaken.

It should be particularly noted that all test data and performance curves produced shall be presented in the units as described in the variation above.

In addition to the test point required to establish the guaranteed performance, a sufficient number of test points shall be measured so as to establish the shape of the full performance curve as presented in the Tender.

During the execution of the performance test, the mechanical operation of the pump shall be monitored with particular reference to abnormal temperature, noise, vibration and leaks.

Failure to achieve the rated (guarantee) point may render the equipment liable for rejection. Should this occur the manufacturer/supplier shall then be responsible to rectify the equipment to achieve such guarantees at own expense.

3.2 Site acceptance tests

Each pump shall be subject to a mechanical commissioning run to ensure that it is operating in accordance with its intended design duty and that there is no undue noise, vibration or excessive heating of the units.

3.3 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.

4. DESIGN

4.1 General

4.1.1 *Characteristic Curve*

The pumps are to be selected so as to have stable, non-overloading characteristic curves.

Pump characteristic curves shall show head, efficiency, power demand and NPSH required, plotted against discharge flow rate in metric units at the rated impeller diameter and speed required to satisfy the rated (guarantee) duty.

Measurement	Preferred Unit	Symbol
Differential head	Meters	(m)
Discharge flow	Litres per second	(l/s)
Efficiency	Percent	(%)
Power absorbed	Kilowatt	(kW)
NPSHr	Meters	(m)
Impeller diameter	Millimeters	(mm)

Speed	Revolutions per minute	(rpm)

The performance curves shall indicate pump performance characteristics at maximum, minimum and rated impeller diameters.

4.2 Prime movers

4.2.1 *Defined operating conditions*

Delete the Sub-Clause and substitute:

The prime movers power output rating shall equal or exceed at least the following margins according to the pump's absorbed power demand at the rated (guarantee) point.

Margin	Description	Value
50%	For pumps requiring up to	2 kW
40%	For pumps requiring from	2 to 5 kW
30%	For pumps requiring from	5 to 10 kW
20%	For pumps requiring from	10 to 30 kW
15%	For pumps requiring from	30 to 100 kW
10%	For pumps requiring	Over 100 kW

Where a unit may be subjected to operating at a run-out duty point condition, the power output rating of the prime mover shall be at least 5% greater than the power absorbed by the pump at this point.

4.3 Critical speed, balance and vibration

4.3.1 *Balance and vibration*

Add to the Sub-Clause:

Rotating elements shall be statically and dynamically balanced according to ISO 1940-1:2003 to a balance quality grade of G2.5. Balancing certificates shall be submitted where specified, in an approved format.

Failure to achieve the vibration limits specified may render the equipment liable for rejection. The Contractor shall be responsible to rectify the equipment to achieve the specified limits at his own expense.

5. MECHANICAL FEATURES

5.1 Dismantling

The manufacturer/supplier must include for and indicate in their offer any special tools required for operation and or maintenance of the pumping units.

5.2 Impellers

5.2.1 *Impeller design*

Vortex type with hardened edges.

The rated impeller diameter shall not exceed 95% of full diameter. Similarly the rated impeller diameter shall not be less than 105% of the minimum diameter.

Pumps that are required to handle raw sewage or similar medium shall be capable of passing solids corresponding to an 80 mm diameter sphere as well as rags, paper and other stringy material without clogging.

5.3 Shaft Sealing

5.3.1 *General*

The preference for either packed glands or mechanical seals shall be specified in the data sheets. If no preference is stated the supplier shall provide his standard design arrangement or alternatively advise otherwise.

5.4 Nameplate

Nameplates shall be securely attached to the pump.

The minimum information required on the nameplate shall be name (or trademark) and address of the manufacturer or supplier, identification number of the pump (for example, serial number or product number), model type and size, rated (guarantee) flow, rated (guarantee) head, rated speed and actual impeller diameter.

5.5 Shop inspection and tests

A hydrostatic test shall be performed for pressure-containing parts of a pump at a test pressure of at least 1.5 times the basic design pressure. This pressure shall be maintained for a period of at least 10 minutes.

6 MEASUREMENT AND PAYMENT

6.1 Design and supply

Measurement of payment will be for the unit supplied including all ancillary equipment and accessories as specified.

The tendered rate shall include for design, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

Measurement of payment will be for the unit supplied including all ancillary equipment and accessories as specified.

The tendered rate shall include for the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, in complete working order.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M7: VALVES

SECTION M7001: GENERAL VALVES

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SERIES M7: VALVES

SECTION M7001: GENERAL VALVES

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 valves.

2. DESIGN SPECIFICATION

2.1 General

This specification covers valves required to be used on the more common applications. Where special valves are necessary for specific applications, the Tenderer must select suitable valves and provide details with his tender submittals for approval by the Engineer.

2.2 Construction and design

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

Valves shall be double-flanged unless unavailable or otherwise specified.

Valves and their method of actuation shall be designed to provide operation under the full pressure rating of the valve.

2.3 Operating direction

The handwheel, lever, etc. on valves, valve actuators and valve gearboxes shall be clockwise closing unless otherwise specified.

2.4 Position indication

All valves, including valves with gearboxes and valves with actuators, shall be provided with indication of current position as well as indication of closing and/or opening direction. Valves with configurations which make this information apparent will be acceptable.

2.5 Corrosion protection

The specific application shall be taken into account in the corrosion protection of valves.

Cast iron valve components, including valve bodies, shall be protected with System - Fusion Bonded Epoxy.

2.6 Fasteners

Valve and valve gearbox fasteners shall be of grade 316 stainless steel.

3. MATERIALS OF CONSTRUCTION

3.1 Cast iron gate valves (Wedge Gate)

Wedge gate valves shall be used on raw water and treated water duties but shall not be used on raw sewage, raw water, effluent, sludge and general duties where some solids may be present. The valves shall comply with the following:

The valves shall comply with SANS 664 or SANS 665, Class 10 or higher as required.

The valves shall be double flanged.

Valve bodies, handwheels and bonnets shall be manufactured from spheroidal graphite iron, free from blow holes and carefully fettled after casting to remove surface imperfections. Spindles shall be manufactured from or stainless steel or equal approved material according to the duty requirements. The body shall be provided with channel guides and the gate shall be provided with shoes. Guides and shoes shall be of copper alloy or stainless steel and shall guide the gate along the complete travel distance. Spindle seals shall be of the nitrite rubber 'O' ring type with bush insert and provided with an external scraper ring. Replacement of the seals shall be possible with the valve under pressure.

Fixing lugs for end of travel limit switches shall be provided.

Valves shall have rising spindles unless otherwise specified or necessary. Non-rising spindle valves shall be fitted with indicators showing the valve opening position.

Hand-wheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.

Extensions spindles shall be manufactured from 316L stainless steel. Headstocks shall be manufactured from stainless steel 316L steel or cast iron and to a pattern approved by the Engineer.

Valves larger than DN 150 shall be provided with bypass arrangements.

Valves larger than DN 250 shall be provided with doors for inspection and cleaning.

3.2 Cast iron gate valves with resilient seals

Resilient seal gate valves may be used on raw sewage, raw water, effluent and general duties where some solids may be present but must not be used on high solid applications such as sludge and grit duties.

The valves shall comply with SANS 664 or SANS 665, Class 10 or higher as required.

The valves shall be double flanged. Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Non-rising spindle valves shall be fitted with indicators showing the valve opening position.

Valve bodies, handwheels and bonnets shall be manufactured from spheroidal graphite iron, free from blow holes and carefully fettled after casting to remove surface imperfections. Spindles shall be manufactured from or stainless steel or EN57 or equal approved material according to the duty requirements. At least two spindle seals of the nitrile rubber “O” sealing rings in a corrosion resistant housing shall be provided, along with one nitrile rubber wiper ring to prevent the ingress of dirt. Replacement of the seals shall be possible with the valve under pressure.

Handwheels shall be of cast-iron.

Fixing lugs for end of travel limit switches shall be provided

Handwheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.

Valves larger than DN 150 shall be provided with bypass arrangements.

3.3 Knife gate valves

Knife-gate valves must be used on water sludges as well as on primary, waste activated and digested sludge duties. They shall also be used on other high solids application and may be used for duties specified under Clause "Cast Iron Gate Valves with Resilient Seals".

Valves shall be Insamcor HDH CI STD, or equivalent, with cast iron bodies, stainless steel blades, cast handwheels, and no carbon steel parts.

Valves for water sludges shall be anti-clockwise closing. Valves for primary, waste activated and digested sludges shall be clockwise closing.

Valves shall have chamfered blade edges and resilient body seals, and may have either rising or non-rising spindles. Gate position indication shall be provided if the overall design does not make this apparent. The blade shall be loaded through its central plane during opening and closing and this shall be achieved by the use of a clevis link or similar.

Blade scrapers shall be incorporated to protect the body seal and valve chest. As the valve is opened, the scrapers shall clean the blade surfaces before these contact the body seal. The scrapers shall be of a non-elastomeric, non-metallic material and shall be designed to cause minimal damage to the blade.

Valves shall be droptight in either flow direction. Suitable sealing shall be provided to prevent leakage from the valve and it shall be possible to adjust these seals while the valve is in line under pressure.

Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating in accordance with System - Fusion Bonded Epoxy.

Valves shall be double-flanged and shall suit the standard flange rating but may incorporate drilled and tapped fastener holes (the type of valve which is clamped between two flanges will be considered for acceptance only in positions where it is very likely that the pipe or flanged item on either side will never have to be removed or if isolation will not be necessary if it is removed). Fasteners may be studs or setscrews manufactured to suit the tapping depth.

3.4 Butterfly valves

Butterfly valves are for the use on air, gas and clean liquid duties and for the use on raw and potable water duties, shall comply with SANS 1849.

Butterfly valves shall be of the resilient seal type with suitably lined cast iron body and a lined or 316 stainless steel blade. Valve shafts and thrust pads for cast iron valves shall be of

stainless steel 316L and seating rings of gun-metal or stainless steel 316L, or approved synthetic material to suit the application. Valves, except where stated, shall be resilient seal type with neoprene blade seal, suitable for the working pressure. Bearing bushes are to be of 'Vesconite,' Teflon or similar approved material and gland seals of neoprene. Hand lever valve actuation with a locking system for incremental valve setting from fully shut too fully open shall be provided for valves up to and including DN 200. Valves larger than DN 200 shall be equipped with robust, weatherproof grease-filled gearboxes with an indicator to show the degree of valve opening.

Valves shall be air, gas and water tight when closed.

For normal usage, the valves may be of the type which is clamped between two flanges. Where it is necessary to remove equipment on either side for maintenance purposes, suitable spacer pipes must be provided or the valves shall be flanged and provided with drilled and tapped holes.
The valves shall be installed with horizontal disc shafts.

3.5 Check valves

3.5.1. General

A shut-off valve shall be installed downstream of each check valve.

The check valve installation shall ensure that flaps are able to open fully without being impeded by, for example, a shut-off valve, bend or pipework internal lining. Where a check valve is located close to another valve, an intervening spool piece with a minimum flange-to-flange length of 1,5 times the valve diameter shall be provided.

Bronze swing type check valves may be used for pipework up to DN 50.

3.5.2. Check valves for water

Check valves for treated water and raw water duty shall be of the double-flap, positive-closing type.

Bodies shall be of cast-iron or cast-steel. Flaps shall be of the light, leaf type, shall be of bronze or stainless steel with machined sealing faces, shall be specifically designed to be non-sticking, and shall have Teflon bearing washers. The gate, swing arm and hinge shall be designed to carry full shock loading on closure. Seals shall be of resilient material. The axis of rotation of the flaps shall be vertical, pins shall be of 316 stainless steel and closure shall be initiated by stainless steel springs, suitably rated for the duty so that closing is initiated prior to the onset of reverse flow. The valves shall seal effectively under all operating conditions and 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 the springs or external counterweights.

Positive, external indication of the position of both plates shall be provided.

3.5.3. Swing check valves

Swing check valves shall be used on all sewage, sludge or similar applications. Valves for use with sewage, effluent or sludge shall be self cleansing at the base of the gate.

Swing check valves shall be flanged, shall be of all iron construction suitable for a working pressure of at least 1 000 KPa, and shall be fitted with a side lever and adjustable weight. External levers and counterweights shall be fitted to the hinge shaft which shall be extended

through the valve body and provided with nitrile rubber 'O' ring seals which may be replaced with the valve under pressure. The level and counterweight shall be provided with facilities for adjusting the angle and weight positions.

Orientation of the valve installation shall comply with the manufacturer's recommendation.

3.6 Pinch valves

All isolating valves at pump installations to have rising spindles.

Pinch valve sleeves shall be manufactured form high strength synthetic fiber or steel cord reinforcement. The sleeve liner is to be natural rubber. The sleeves are to be tested to twice their maximum working pressure and supplied with a test certificate. The closing mechanism is to be design for ease of operation under pressure. The valve is to be supplied with an indicator for open/close indication. Where called for, pinch valves may be used as control valves with either electro-mechanical, pneumatic or hydraulic operation.

3.7 Bronze isolating valves

May be used for isolating duties on clean air and liquid duties up to DN 50.

Bronze gate valves shall be to SANS 77 Ball or plug valves of appropriate construction may also be used where preferred.

3.8 Rubber diaphragm valves

To be used on sludge and other dirty or corrosive liquid duties requiring valves up to DN 350. May also be used on clean liquid duties.

Rubber diaphragm valves shall preferably be of the straight through type with the diaphragm made of natural rubber.

This type of valve shall not be used on the suction side of pumps or on any line subject to vacuum.

3.9 Needle valves (above DN 150)

Needle valves shall be used for the regulation of flow and/or pressure in pipelines containing water where the size is DN 150 or greater unless this is overridden by the requirements of the Detailed Specification. The configuration shall be double-flanged with co-axial flanges unless otherwise specified.

The seal seat and associated downstream parts shall be selected to prevent any cavitation for the application. Such parts shall be of stainless steel or copper based alloy.

3.10 Air valves

Air valves for water shall be of the non-slamming type, Vent-O-Mat, ARI or equivalent.

Air valves for sewage and similar duties shall be specifically designed for the application.

Air valves shall be installed above pockets designed to collect air. The pockets shall be designed in accordance with the requirements for nozzles in pipe-work. The diameter of the nozzle shall be at least half the diameter of the parent pipe work.

Air valves shall preferably be flanged and shall be provided with isolating cocks.

3.11 Corrosion Protection

Corrosin protection shall be carried out strictly in accordance with the Standard Specifciation for General Corrosion Protection.

All vavles unless otherwise specified are to conform to System – Fusion Bonded Epoxy.

4. TESTING AND COMMISSIONING

4.1 Tests on completion

Performance testing will be carried out on the equipment after commissioning and adjustment. All tests are to be witnessed by the Engineer, and contractors must give the Engineer 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. Smooth and efficient operation of the valves.

2. Appropriate closing direction of the valves according to the above specification.

3. The torque doesn't exceed the torque stated in the data sheets.

The equipment will be considered acceptable when:

1. The equipment meets the duty requirements as defined in this section of the Specification and stated in the data sheets.

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.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M9 SCREENING

SECTION M9002: HAND RAKED BAR SCREEN

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SERIES M9 SCREENING

SECTION M9002: HAND RAKED BAR SCREEN

1. SCOPE

This specification covers the design, 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 hand raked bar screens.

2. DESIGN SPECIFICATIONS

2.1 General

The screen must be able to handle various types of suspended solids such as pieces of timber, cloth, string or any other fibrous materials, metal objects, rocks, sheets of paper and any materials which are likely to be present in the influent under typical South African conditions. The
Bar spacing must be between 35-45 mm.

The hand raked bar screen shall be sufficiently robust to prevent bending and deformation of the bars under normal operating conditions and to have the required bar profile for minimal head loss. The bar spacing is to be as specified in the technical data sheets. Recesses in the walls and floor of the concrete channel are to be cast by the civil contractor for the screen to be of a minimum obstruction to the flow. The top of the screen is to be level with the top of the channel when installed. The civil contractor is to grout in the screen once installation has been completed. A hand rake with teeth in proportion to the bar spacing is to be provided along with the screen.

3. MATERIALS OF CONSTRUCTION

3.1 General

The screen is to be fabricated from stainless steel 316L and to be pickled and passivated. All fasteners are to be of stainless steel 316L. The screen must be mounted at 70 degrees.

3.2 Name plates

A name plate, placed in a viewable position, is to be provided with the following information:

Manufacturers name

Supplier’s name

Serial number

Type

4. TESTING AND COMMISSIONING

Performance testing will be carried out on the equipment after commissioning and training of the Council’s employees. The tests will be performed on the equipment over a single 8 hour shift.

These tests shall consist of the following:

- Efficient operation of the screen under all operating conditions including simulation of capability using rocks, wood, metal, and other debris (within reason and simulating expected debris in the incoming flow) deposited into the channel ahead of the screen; and
- Fast and efficient removal of screenings with the use of the hand rake without the teeth of the rake jamming in the bars of the screen.

The equipment will be considered acceptable when:

- The above tests have been sufficiently met.

During 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.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M10 MECHANICAL FLUID CONTROL EQUIPMENT

SECTION M10001: FLUID CONTROL EQUIPMENT

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SERIES M10 MECHANICAL FLUID CONTROL EQUIPMENT

SECTION M10001: FLUID CONTROL EQUIPMENT

1. SCOPE

This specification covers 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.

2. DESIGN SPECIFICATION

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 316L 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.

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 316L mounting flanges bonded to the covers.

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 316L. Wall mounted gates are to be manufactured in stainless steel 316L 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.

2.3 Twistlock gates

Twistlock 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.

2.4 Channel gates

Channel Gates shall be of robust construction suitable for the required duty and shall be fabricated in stainless steel 316L. Channel gates are to be manufactured in stainless steel 316L 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 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 316L mounting flanges bonded to the covers.

The frame of the channel gate is to be embedded into the channel. Provisions for blockouts 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.

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 316L Downward opening weir gates are to be manufactured in stainless steel 316L 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.

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 316L. Tilting weir gates are to be manufactured in stainless steel 316L 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 316L mounting flanges bonded to the covers.

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.

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.

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.

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.

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.

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.

2.11 Fasteners

All fasteners are to be manufactured from stainless steel 316L

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

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

Size and type

3. MATERIALS OF CONSTRUCTION

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
- Hand wheels : System A/1
- Electric actuators : System B/1

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 Engineer, and contractors must give the Engineer 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).

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.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M20 LIFTING EQUIPMENT

SECTION M20001: OVERHEAD TRAVELLING CRANES

TABLES OF CONTENTS

SERIES M20 LIFTING EQUIPMENT

SECTION M20001: OVERHEAD TRAVELLING CRANES

1. SCOPE

This specification covers the design, 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 overhead travelling cranes.

2. DESIGN SPECIFICATION

2.1 General

The Tenderer shall inspect the drawings to determine what steps need to be taken for installation of the crane and shall plan work on Site accordingly. Design requirements for installation of the crane rails shall be provided by the Contractor.

Construction of the crane shall be in accordance with ISO 16880, SANS 10160, SANS 10162 and SANS 1431.

2.2 Overhead travelling cranes

The Contractor may use a crane during the installation of other equipment on condition that all testing and certification for the complete lifting installation, including supporting structure, has been successfully completed.

The hoist shall be supported on and travel along a fabricated steel crane beam structure. The crane beam shall be supported on and travel along crane rails. The rails shall be supported along their full length, either on a concrete ring beam or on additional hot-dip galvanised steel beams.

The Contractor's proposed method of fixing the crane rails shall be submitted to the Engineer for approval.

The crane's safe working load rating shall be stated in the tender submission.

The crane long travel, cross travel and hoist shall be electrically-powered or manually operated as stated in the Technical Data Sheets.

The crane duty shall be stated in the Technical Data Sheets.

Unless otherwise stated, the lowest hook level shall be room floor level and all operating chains shall fall to one metre above this level.

All materials shall be new and unused and suited to the application. Structural steelwork shall comply with the requirements of SANS 1431 and the grade used for structural members shall be 350 W.

Site welding will not be acceptable. All welding shall be continuous unless otherwise approved in writing by the Engineer. No crevices will be permitted. All welding slag and weld spatter shall be removed and welds shall be ground smooth prior to coating. All welds shall be free of blowholes. Sharp edges resulting from cutting operations shall be rounded to a

radius of at least 3 mm and open pockets which are inaccessible for preparation and coating will not be permitted.

The crane beam and end carriages shall be designed with suitable dimensions, wheel spacing and gusset plates or diagonal bracing to prevent cross-whipping.

End stops with rubber buffers shall be fitted to prevent the hoist from moving off the travelling beam and to limit the long travel along the rails.

Lubrication systems shall be designed to exclude dirt and moisture and all gear wheels shall be fully enclosed.

Bearings shall be mounted in properly sealed plummer blocks or in totally enclosed and sealed housings, grease-lubricated and provided with grease nipples in both cases. The open type bearing units with exposed "lubricated for life" bearings will not be acceptable.

The safe working load shall be permanently marked on the crane hook and on both sides of the girder.

The hoist, if powered, shall comply in all applicable respects with the Occupational Health and Safety Act.

An overload prevention device, such as a clutch which slips upon overloading, shall be incorporated.
The bottom hook shall swivel on a ball or roller bearing through 360º and shall be fitted with a safety latch. The bearing shall have a protective skirt.

Lifting chain is preferred, but corrosion protected steel wire rope is acceptable for higher loads.

A chain box for the unloaded length of lifting chain shall be provided.

The crane rails shall be supported on and secured to the concrete or steel gantry beams and shall be installed true to span, level, aligned, and shall be straight to within the permissible deviations given in ISO 16880 over their entire length. The crane rails shall be made from standard rail sections. Rails manufactured from square section steel bar will not be acceptable. Rails shall be joined using fish-plates, with at least four fasteners, to provide a continuous path for the travel of the crane wheels. The rails shall be hot-dip galvanized after all fabrication work.

The distance between rail supports shall not exceed 1 000 mm and supports shall be anchored using grade 316 stainless steel bolts.

Where specified, a personnel platform for two people shall be provided on the crane structure. The platform shall be bolted to the crane beam structure and shall be removable. The steel sections which form the crane beam shall be provided with welded lugs to which the platform shall be bolted. The complete platform and all guard-railing shall be hot-dip galvanised after fabrication. The platform itself shall be designed so that a person standing on it will be able to replace the electric lamps. A hot-dip galvanised steel ladder shall be provided for accessing the platform. The platform floor shall have a minimum width of 500 mm.

2.3 Hoists

Hoists shall be provided with a slipping clutch, or equivalent, which shall ensure that it is not possible to overload the hoist.

Powered hoists shall hold the load upon power failure; i.e. shall feature fail-to-safe braking.

2.4 Fasteners

Crane rail anchor bolts shall be M16 or larger and shall be of grade 316 stainless steel. Fasteners smaller than 12 mm shall be of 316 stainless steel. All other fasteners, including high-tensile fasteners, shall be of stainless steel or shall be hot-dip galvanized.

Before assembly, the threads of all bolts and studs shall be coated with an approved nickel-based, anti-seize corrosion protection compound.

3. MATERIALS OF CONSTRUCTION

3.1 Corrosion protection

The crane beam and end carriages shall be zinc-sprayed and sealed in accordance with the below systems. Smaller items, such as cable brackets and protective covers, shall be hot-dip galvanized accordingly.

System	Details	Item
System C/2	Zinc sprayed	Crane beam
System – hot Dipped Galvanised	HDG	Smaller items

Where the Tenderer prefers to offer corrosion protection systems other than those specified, these may be offered as an alternative with full details of such recommended systems. The Council reserves the right to reject such offers if considered inadequate by the Engineer.

The Contractor shall arrange for the crane to be inspected by the Engineer at the fabricator's premises prior to preparation for corrosion protection.

The crane final colour shall be Golden Yellow, B49.

The inspection of corrosion protection systems shall be done in accordance with the Standard Specification for Corrosion Protection.

3.2 Installation

The crane and rails, when erected and installed, shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
In the alignment of equipment or structures, the use of multiple shims will not be permitted. All shimmed feet shall be neatly grouted to provide corrosion protection.

The full length of the rails shall be grouted in cases in which the rails rest on a concrete ring beam. A suitable gap between the rails and the beam shall be provided for application of the grout. The grout shall be applied strictly in accordance with the manufacturer's instructions. The grout shall be neatly finished with a 45º chamfer. The Engineer shall be notified prior to application of the grout.

Grouting shall be done using a non-shrink cementitious grout, ABE Duragrout 1000 or equivalent, to the approval of the Engineer and in accordance with the manufacturing instructions.

4. TESTING AND COMMISSIONING

All tests are to be witnessed by the Engineer, and contractors must give the Engineer 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.

Works testing of the individual assembled items of equipment shall be undertaken at the manufacturer's premises to demonstrate the effective operation of the crane.

Before being put into use the crane shall be load tested in position by the Contractor to 1.25 times the maximum safe working load and the Contractor shall arrange for this test to be witnessed by the Engineer. The Contractor shall then supply a test certificate once the crane passes the load test.

Performance testing shall be carried over a single 8 hour shift and shall consist of the following:

- Measurement of power absorbed by all motors; and
- The vibration measured at each point does not exceed the level prescribed in ISO 10816.

The equipment will be considered acceptable when:

- The Contractor supplies the Engineer with a certificate from the manufacturer which:
    - Certifies that the crane has been manufactured in accordance with the requirements of the Occupational Health and Safety Act;
    - Specifies the design standards used;
    - States the safe working load and the test load, and;
    - This certificate shall be provided to the Engineer prior to delivery of the crane to Site.
- Where a power test is required, the power absorbed by each motor at duty point does not exceed the values stated in the Technical Data Sheets;
- The equipment meets the duty requirements as defined in this section of the Specification; and
- Where a vibration test is required, the vibration measured at each point does not exceed the level prescribed in ISO 10816, as given in the General Specification for the appropriate class of machine.

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.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M20 LIFTING EQUIPMENT

SECTION M20002: CHAIN BLOCKS AND CRAWL BEAMS

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SERIES M20 LIFTING EQUIPMENT

SECTION M20002: CHAIN BLOCKS AND CRAWL BEAMS

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 for chain blocks and crawl beams.

2. DESIGN SPECIFICATION

2.1 Chain blocks

The chain block casing is to be fabricated from cast iron or high strength grade alloy steel with hot dipped galvanised finish and painted to System E/4. The chains are to be high strength alloy steel and hot dipped galvanised for corrosion protection. A slipping clutch, or equivalent, is to be fitted to ensure that it is not possible to overload the chain block. A trolley, along with all ancillary equipment, is to be provided with the chain block for operation on the crawl beam.

The safe working load (SWL) is to be clearly displayed on either side of the casing of the chain block.

2.2 Crawl beams

Crawl beams shall be fastened to hot-dip galvanised steel support structures using hot-dip galvanised fasteners and it shall be noted that high-tensile, hot-dip galvanised fasteners are available in South Africa.

Crawl beams shall be anchored to concrete using grade 316L anchor bolts. The anchor bolts shall, preferably, be through-bolted. If chemical anchor is used, every anchor shall be load-tested prior to installation of the beam. A nickel-based anti-seize compound shall be applied to bolt threads prior to fastening of the nut and galled fasteners shall be removed and replaced.

Stoppers must be fitted to the open end of the crawl beams so the crawl cannot derail.

The permissible allowable payload must be painted onto the beam.

The safe working load (SWL) of the crawl beam is to be clearly displayed.

3. MATERIALS OF CONSTRUCTION

3.1 Corrosion protection

The corrosion protection of the chain blocks are to be as specified by the supplier.

Crawl beams shall be hot-dip galvanised after all fabrication. If the beam is drilled or welded or the zinc coating is damaged by any other fabrication technique, the complete beam shall have the zinc removed by abrasive blasting and it shall be returned to the galvanisers for hot-dip galvanising. Repair using cold-applied zinc products will not be acceptable. Final painting of the crawl beam shall be to System E/4.

4. TESTING AND COMMISSIONING

All tests are to be witnessed by the Engineer, and contractors must give the Engineer 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.

Before being put into use, the crawl beam and chain block shall be load tested by the Contractor to 1.25 times the maximum safe working load and the Contractor shall arrange for this test to be witnessed by the Engineer. The Contractor shall then supply a test certificate once the crane passes the load test.

Performance testing shall be carried over a single 8 hour shift and shall consist of the following:

The requirements stated in the Technical Datasheets

The equipment will be considered acceptable when:

The crawl beam and chain block passes the load tests.

The Contractor supplies the Engineer with a certificate from the manufacturer which:

- Certifies that the crane has been manufactured in accordance with the requirements of the Occupational Health and Safety Act;
- Specifies the design standards used;
- States the safe working load and the test load, and;

The equipment meets the duty requirements as defined in this section of the Specification.

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.

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.

6. PAYMENT AND MEASUREMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

SERIES M20 LIFTING EQUIPMENT

SECTION M20003: DAVITS AND WINCHES

TABLES OF CONTENTS

SERIES M20 LIFTING EQUIPMENT

SECTION M20003: DAVITS AND WINCHES

1. SCOPE

This specification covers the design, 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 davits and winches.

2. DESIGN SPECIFICATIONS

2.1 Davits

Davits shall be column mounted with swivelling booms and designed to suit the application. The arrangement shall permit easy and safe lifting of the load to a convenient height not less than 500 mm clear of ground level or high enough to permit the load to be swung clear of any obstruction through an angle of at least 180o.

The davit shall be designed for a maximum safe working load at least 50 % above the calculated actual load requirements. The maximum stress permitted in any component at the design load shall be the lesser of:

- One quarter the ultimate tensile stress for the material; and
- One half the yield stress or 0,2% proof stress of the material (as applicable).

The contractor's design calculations shall be submitted to the Engineer for inspection before manufacture may proceed.

Where a portable davit is specified, the construction shall be as light as possible while still complying with the above. Shall be collapsible to make it easy to carry, and be easily removed from or remounted on permanent fittings which shall be provided in the various positions where the davit is to be used.

Each davit shall be provided with a winch rigidly fixed to the davit at a convenient height and position. When portable davits are to be used for lifting submerged or otherwise inaccessible equipment the required length of rope shall be provided for each item of equipment, with the bottom end attached to the equipment (load) and, during normal operation, with the upper end detached from the winch, neatly coiled and tied in a convenient position. A protection system shall be provided which will prevent the rope from being dropped and lost when being attached to or detached from the winch.

Guide pulleys to suit the arrangement shall be provided. These pulleys shall be machined with a groove having a radius 5 to 7,5% greater than the rope radius and with a flare angle of 52o. The pulley sheaves shall have a diameter at the bottom of the groove of not less than 25 times the wire rope diameter. The groove depth shall be twice the rope diameter or greater.

Operating cross bars, locking arrangements, fixing arrangements, etc., shall not represent a hazard to passers by in any way. If necessary, operating levers shall be hinged so that they can be swung out of the way when not in use.

2.2 Winches

Hand cranked winches shall be rated for a safe working load at least 100 % in excess of the calculated load. All gears, clutches, etc., shall be enclosed in a robust cast iron or cast steel casing which shall be grease filled and sealed against ingress of dirt and moisture. The winch shall be designed to hold the load stationary when the hand crank is released during raising or lowering. In addition, a locking arrangement to lock the position of the load shall be provided.

The force required to operate the winch at its maximum rated load shall not exceed 100 N.

The radius at which the handle operates shall preferably be adjustable. A double handled crank or two opposing cranks shall be provided when necessary to ensure easy operation in all positions possible with the mounting arrangement provided.

3. MATERIALS OF CONSTRUCTION

3.1 Davits

The davit shall be manufactured from mild steel, be hot-dip galvanised and painted to System E/4 when not in use near water but shall be fabricated from 304L or 316L stainless steel when in use near water. All fasteners, pins, shafts, shackles, hooks, etc., shall be of 316L stainless steel. Guide pulleys and shafts shall be made of 316L stainless steel or other approved corrosion resistant material, and use suitable non-metallic bearings which do not need to be lubricated.

The swivelling arrangement shall be properly designed for easy operation, shall be accurately fitted and shall not be subject to corrosion problems. Bushes made of nylon, "Vesconite" or other suitable non-metallic material shall be used and any metallic rubbing mating face shall be of 316 stainless steel.

3.2 Winches

The wire rope and all attachments shall be of 316 stainless steel with a safety factor of at least 6. The wire rope shall be long enough to reach the lowest required position with at least 3 turns left on the drum. The drum size shall easily store the full rope length. The inside diameter of the drum shall suit the rope diameter in accordance with good engineering practice approved by the wire rope manufacturer.

The maximum safe working load shall be clearly and permanently marked on the winch. The drum support brackets, all exposed fasteners, shafts, handles, pins, etc., shall be 316 stainless steel and the casing shall be hot-dip galvanized or zinc-sprayed (to a thickness of 150 µm) and then painted System E/4.

4. TESTING AND COMMISSIONING

Performance testing will be carried out on the equipment.

The safe working load shall be clearly and permanently marked on the davit jib, winches and shackles. Before being put into use each davit assembly shall be load tested in position by the Contractor to 1.1 times the maximum safe working load and the Contractor shall arrange for this test to be witnessed by the Engineer. All tests are to be witnessed by the Engineer, and contractors must give the Engineer 14 days notice prior to any test. The Contractor shall then supply a test certificate once the davit passes the load test.

The tests will be performed on the equipment over a single 8 hour shift.

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.

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.

6. MEASUREMENT AND PAYMENT

6.1 Design and supply

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, manufacture, factory testing, supply, delivery and storage on site of the unit.

6.2 Installation and commissioning

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 the installation, fixing of corrosion protection where needed and commissioning of the unit supplied, and for all other costs and actions that are necessary for obtaining an efficient and complete working system.

Payment will only be transferred once the engineer has received full Operation and Maintenance Manuals along with the relevant plant drawings.

PART C: ELECTRONIC AND TELEMETRY WORKS

PS4: Standard Electronic Specifications

CONTENT

1. ELECTROMAGNETIC FLOW METERS

General

a) Transmitter flow tubes shall operate on the law of electromagnetic induction principle. They shall be of the compact type and suitable for field mounting taking all manufacturer protection guidelines and specifications into consideration.
b) The flow meter shall be suitable for use in pipelines that are cathodically protected.
c) The flow meter shall be supplied complete with all flanges, gaskets and earthing rings.
d) A primary head simulator shall be offered as an option.
e) Empty pipe detection shall be included as a standard function
f) Field excitation shall be pulsed AC or D.C. AC pulsed exciting shall be used for pulsating flow, media with low conductivity and media with high percentage of solids.

Specifications

Connection flange rating	:	To suit pipeline pressure rating
Connection flange material	:	Or Ni Steel - depending on application
TubeMaterial	:	(1, 4301) - depending on application
Liner Material	:	PFA, Polyurethane rubber, soft natural rubber, EPDM, PTFE (Teflon) or ceramic depending on application i.e. chemical resistance and temperature limitations
Electrode Material	:	316SS, Hastelloy, Tantalum, Platinum/Iridium or Titanium depending on application temperature and estimated corrosion rate
Meter Casing	:	Stainless steel
Power Supply	:	24V DC or 220V AC
Enclosure Class	:	IP65 or IP 68 depending on application
Ambient Temperature Range	:	Application dependant
Electrical Connections	:	M20 entry for cable glands
Installation	:	Flanged

Signal converter

a) Transmitter electronics shall be either head mounted or remotely mounted depending on application.
b) The ingress protection rating of the converter shall be the same as for the primary element, typically IP65 or IP 68, unless a remotely mounted converter is used. In this instance the converter shall be installed in an Instrument panel with an IP rating of IP65
c) Transmitter shall have microprocessor based electronics with local flow indication and ability to display and change, on-line, range and units.
d) The low-flow cut-out shall be user configurable.
e) Parameter and data storage shall be kept in non-volatile memory.

f) Output shall be 4 to 20mA, isolated. Where transmitters have dual ranges, each range shall have a separate output.
g) Totalizer pulsed output shall be maximum 10 pps with a minimum pulse width of 50ms.

Specifications

Accuracy	:	0.5% of span over a velocity range > 0.5ms 0.025% of span over a velocity range < 0.5ms
Repeatability	:	0.1% of span
Ambient temperature effect	:	0.01% per °C changes
Minimum sensitivity	:	5 uS/cm
Turndown ration	:	1:1000

2. VORTEX FLOW METERS

General

a) Vortex shedding meters shall operate by detecting eddies shed by a bluff body inserted into the stream to be measured, where the number of vortices shed by the bluff body are proportional to the flow rate.
b) Vortex precession (Swirl meters), when used, are used primarily on clean gas services. A fixed impeller sets up the swirl, which is detected by a sensor. The number of "swirls" is proportional to flow rate. Since it has lower tolerances than the Vortex Shedding meter, and is expensive, it is not used.

Specifications

Connecting flange rating	:	To piping specification
Connecting flange material	:	Carbon steel
Meter body material	:	304 Stainless steel
Trim	:	316 stainless steel

Signal Converter

a) Transmitter electronics shall be either head mounted or remote mounted depending on application.
b) Transmitter shall have microprocessor based electronics with local flow indication and ability to display and change on/line, range and units.
c) Electrical connection : 20 mm ISO
d) Output from amplifier : 4 to 20mA, linear

Specifications

Accuracy	:	± 0, 5% FS over the normal flow range
Repeatability	:	± 0, 15%

3. TURBINE FLOW METERS

General

a) Turbine meters shall consist of meter housing with a rotor in the flow stream. The angular velocity of the rotor shall be detected by a magnetic follower, which in turn drives a mechanical counter.
b) All meters shall be delivered complete with a facility to pick up the flow rate pulses for conversion into an electrical signal for transmission to a remote destination. The electrical signal shall be 4 to 20 mA for flow rate plus an impulse with minimum pulse width of 50 ms and maximum rate of 10 pps for remote totalizing. The converters shall be suitable for either local mounting or at a remote location.
c) Compound meters may be used where higher accuracy is required over the full range of flow.
d) Re-ranging of the output shall be possible without major disassembly.
e) The meter shall be installed as per the manufacturer's recommendations of minimum up- and down-stream runs. 3 - 5 pipe diameters are required if the flow is laminar. Straightening vanes shall be used if necessary.

Design

Accuracy	:	2% over normal flow range 5% over the low portion of the range
Connecting flange rating	:	To piping specification
Connecting flange material	:	Carbon steel
Meter body material	:	Cast iron with corrosion resistant lining

Performance

Accuracy	:	± 0, 5% over the normal flow range
Linearity	:	± 0, 5% over the normal flow range

Repeatability : ± 0, 5% at any point on the normal flow range

4. POSITIVE DISPLACEMENT FLOW METERS

General

a) The Positive Displacement meter shall consist of a volumetric metering mechanism in the flow stream, with a local totalising indicator coupled to the mechanism. Remote indication or totalisation shall be done, if required, by a transmitter. The output of the transmitter shall accurately reflect the input pulses representing volumetric units of flow.
b) For accounting applications, accurate compensation for temperature shall be included.
c) A suitable strainer/filter shall be installed upstream to protect the meter.

Design

a) Transmitter electronics shall be either head mounted or remote mounted depending on application.

b) Transmitter shall have microprocessor based electronics with local flow indication and ability to display and change on/line, range and units.
c) Output shall be 4 to 20mA.

Performance

a) Typical accuracy shall be 0, 25% FS.
b) Typical repeatability shall be 0,05%

5. OPEN CHANNEL FLOW METERS

General

a) The flow of liquids in open channels shall be measured by means of either weirs or flumes.
b) The variable head at the weir/flume shall be detected by either capacitance level or an ultrasonic sensor located upstream, clear of the effects of drawdown. Other level-measuring principles, such as the bubbler, may be considered.

Design

a) The design, location and materials for the weir or flume shall be determined by the application, and in accordance with BS 3680, Part 4.
b) Pre-constructed weirs and / or flumes shall be manufactured to the specific standard for the application, and correctly installed at the site.

Weirs

a) Ensure that the nappe has sufficient clearance under maximum flow conditions.
b) Where floating debris exist, broad crested weirs shall be used, unless a suitable debris trap is installed upstream of the weir. Flumes shall be considered.
c) The geometry of the weir shall be selected to suit the application and the expected flow rate.
d) Long-base weirs may be used for river flow measurement where construction of flumes may be impractical.

Flumes

a) Flumes may be selected where there is insufficient fall to permit unobstructed downstream flow from a weir.
b) Flumes may be used where silting at a weir may be a problem, or where floating debris is a problem.
c) The geometry of the flume shall be selected to suit the application.

d) The surfaces shall be smooth, especially near the throat.
e) The structure shall be rigid and watertight, and capable of withstanding flood conditions.
f) Uniform approach of flow is required. The approach channel shall be in the order of 5 times the width of the channel in full flow.

Specifications

Accuracy's	:	Rectangular thin-plate weirs	:	1% to 4%
Broad-crested weirs	:	3% to 5%		
"V" notch weir (20° to 100°	:	1% to 2%		
Triangular profile weirs	:	2% to 5%		
Standing-wave flumes	:	2% to 5%.		

6. ULTRASONIC TRANSMITTERS FOR OPEN CHANNEL FLOW METERS

Transducers

a) Suitable support brackets shall be supplied for the ultrasonic transducers.
b) Integrated temperature sensor for automatic correction of sound time of flight.

Specifications

Enclosure	:	IP65
Membrane	:	Stainless Steel
Electrical Connection	:	M20 cable entry for glands
Max Operating Temperature	:	60°C

Transmitter

a) Preference shall be given to a unit that is "smart" in that calibration and diagnostic checking shall be by hand-held calibrator.
b) The ability of the system to be configured to ignore unwanted signals from obstructions is essential.
c) 4-line LCD for measuring value viewing and set-up required.

Specifications

Enclosure	:	To suit application
Output	:	4-20mA, HART into 250Ω load
Power Supply	:	24V DC
Calibration Adjustments	:	Independent for Zero & span
Accuracy	:	1% of span or better
Resolution	:	1mm
Repeatability	:	0, 2% of span
Dead Band	:	<0, 2% of span
Ambient Temperature Effect	:	<0, 5% of maximum span per 10°C change

7. CAPACITANCE TYPE ‘FLOW’ METER

General

a) This section covers capacitance rods in the open channel located in a gauge well or settling chamber.
b) A counter-electrode shall be supplied and installed into the gauge well.
c) Rods shall be of a material that is compatible with the process media. Coatings, such as Teflon, shall be used to protect the rods in most applications.
d) Preference shall be given to a unit that is "smart" in that calibration and diagnostic checking shall be by hand-held calibration.

Probe

Material	:	Stainless steel
Sheath	:	PTFE
Insertion Length	:	To suit application

Transmitter

Enclosure	:	To suit (IP65)
Output	:	4-20 mA into a 250Ω load
Power Supply	:	24 V DC
Calibration adjustment	:	Independent for Zero & span

Performance

Accuracy	:	1% of span or better
Repeatability	:	0.2% of span
Dead Band	:	<0.2 % of span
Ambient temp, effect	:	< 0.5% if maximum span per 10°C change

8. CLAMP-ON ULTRASONIC FLOW METERS

General

a) Clamp on flow meters shall operate on the time of flight principle. The unit shall be self-contained and shall be battery or mains powered.

Design

Sensors	:	2 ultrasonic sensors
Clamping arrangement	:	The sensors shall be equipped with clamps to enable the sensors to be mounted onto pipes with DN 50 - 3000 mm.
Pipe material	:	Metal, Plastic, Ceramic, Fibre Cement and internally and externally coated pipes.
Power Supply	:	Internal batteries, 231VAC, 24VDC, 12VDC
Carrying Case	:	Aluminium IP54 rated (if the installation is temporary)
Ambient Temperature	:	-10 to +50°C
Totalizer Pulses	:	Maximum 10pps with minimum pulse width of 50ms
Flow Cut-off	:	User configurable

b) The meter shall be equipped with a local LCD display and shall also have an output of 4 - 20 mA. The meter shall have on board logging facilities and printer. The logged data shall be available to a PC via an RS232 link. The software required for the PC interface shall be supplied with the meter.

Specifications

Accuracy	:	1% of measured value
Repeatability	:	1% of measured value
Temperature stability	:	< 0.5% of span per 10°C change

9. VARIABLE AREA FLOW METERS

General

a) Rotameters shall be provided for low flow rates if local indication is required. Rotameters shall also be provided if the rangeability, nonlinearity, viscosity, or hazardous nature of the fluid makes a differential-pressure type instrument unreliable. Rotameters shall have line class block valves upstream and downstream for maintenance.

Design

a) A safety-glass indicating tube shall be provided for pressure below 1000 Kpa and temperatures below 100°C. An armoured tube with magnetic pickup shall be provided for other applications. Armoured meter tubes shall have internal guides.
b) All wetted parts of rotameters on high pressures shall be stainless steel. Teflon or other liner materials shall be considered for corrosive fluids.
c) The manufacturer's standard tube and float shall be supplied to provide a normal flow rate between 40 and 80 percent of the meter capacity. The anticipated minimum and maximum flow rate shall be between 10 and 90 percent of the meter capacity.
d) Rotameters shall be accurate within ± 2% of the full scale and shall have direct reading indicating scales or percentage scales with stainless steel factor tags. Indicating scales shall have full length safety glasses with shields and gaskets on both sides. If percentage scales are used, the scale factor shall be tagged on the rotameters.
e) Rotameters shall have beaded, ribbed or flat tube indicators. Plain tempered tubes are not acceptable.
f) Variable area rotameters shall be completely assembled prior to shipment.
g) Rotameters shall be installed vertically

10. MASS FLOW METERS

General

a) A systems approach to mass flow of liquids is to correct volumetric flow by density. A "flow computer" receives signals from volumetric flow meters and density meters, and mathematically generates the mass flow. Other physical characteristics like temperature, viscosity and pressure may be taken into consideration, depending on the accuracy required.
b) Dedicated mass flow meters, using the Coriolis principle, can determine the mass flow directly.

Design

a) Wetted parts shall be Titanium, unless the application demands another material.
b) The transmitter shall be an intelligent microprocessor device, with multiple 4 to 20mA outputs. Customer defined constants shall be configurable, such as display units, pulse outputs, low flow cut-outs and time constants.
c) Optical (Infra-red) vibration sensors are preferred.

Performance

Accuracy	:	± 0.01 % fsd, or
	:	± 0.2% of reading
Repeatability	:	± 0.005% fsd, or
	:	± 0.1% of reading

Part C4: SITE INFORMATION

C4.1 SITE TOPOGRAPHY

Before tendering, the Tenderer must form his own opinion by his independent enquiry and observation as to the character of the topography or as to any other matter concerning the natural topography and conditions which he may have to deal with during construction/installation, transport offloading, placing and storage of equipment.

Access to the three existing pump stations and along certain areas that cross the stream is to be taken into account with tendering and no additional claims will be entertained on site topography and site constraints which were present at time of tender. The Contractor shall be deemed to have satisfied himself as to the site and topography at time of tender and to have allowed for this accordingly in his tendered rates.

C4.2 ATMOSPHERIC / CLIMATIC CONDITIONS

Mthatha normally receives about 650mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (11mm) in June and the highest (89mm) in February. The average midday temperatures for Mthatha range from 4°C in June and July to 27°C in December, January and February. The region is the coldest during June and July when the mercury drops to 4°C on average during the night.

C4.3 ENVIRONMENTAL

The Environmental Management Specification (EMS) is attached as part of the Particular Specifications. All Work on this contract is subject to the terms of the Record of Decision (ROD) issued by DEDEA and General Authorization issued by DWA. These documents are to be read with the EMP.

It should be noted that it is the contractors responsibility to ensure that the construction works adheres to all relevant environmental statutory provisions, including Section 24 of the Constitution of the Republic which states the “environmental right” of all citizens of the Republic and Section 28 of the National Environmental Management Act, 107 of 1998 (“NEMA”) which outlines the “Duty of Care Principle” and remediation of environmental damage. It will be required that all facilities, materials and construction procedures are compliant in terms of relevant environmental specifications and legislation.

It should be noted that the Employer may at any point request the requisite documentation to prove compliance for any of the materials and inputs used as part of this project. This can include requesting waste disposal receipts, material data handling sheets, air quality permits, licences etc.

The Contractor is to take note of the fauna and flora during tendering and during construction of the Works.

The Construction activities will be monitored by the Employer's Environmental Control Officer (ECO) or agent, being an independent environmental specialist, on a regular basis. The ECO or his agent will be authorised to monitor, on behalf of the Employer, that Works activities comply with the provisions of the ROD, GA and EMP.

The Contractor will be responsible for environmental control on site during construction and will have his own ECO or environmental representative responsible for monitoring and keeping record of all environmental matters on site during construction and the maintenance period, as required.

Work methodologies will be submitted for approval before commencement of the relevant work items.

C4.4 GEOTECHNICAL INVESTIGATION

A geotechnical Investigation was conducted for the Structures and Pipelines, see **Appendix G**.

C4.5 RAINFALL DATA

Mthatha Rainfall Data between 2000 to 2020 was used for this project For Rainfall Data see **Appendix H**.

Part C5: TENDER DRAWINGS

REFER TO VOLUME 3

APPENDIX A: LOCALITY PLAN

APPENDIX B: MONTHLY REPORTING TEMPLATES

LABOUR MONTHLY SUMMARY SHEET

Name of Contractor
Project Name
Project Number
Applicable Month

No of Working Days: Maximum including training = 23 days per month

Number of workers	Surname	Initials	First Name	ID Number	Birth Date	(M)ale / (F)emale	(D)isabled	Rate per day	Number of days worked this month	Number of training days this month	Total amount paid to beneficiary	Course name	Course Code
1											0		
2											0		
3											0		
4											0		
5											0		
6											0		
7											0		
8											0		
9											0		
10											0		
11											0		
12											0		
13											0		
14											0		
15											0		
16											0		
17											0		
18											0		
19													
20											0		
											0		
20	Totals for month								0	0	0		

Signature Consultant

PAYMENT REGISTER

Contractor Name
Period
Project Number
Month:

Name and surname	ID Number	Contact no	Number of Workdays	Task Rate	Payment Due	Signature for Payment Received	Comments

Signature of CLO

Signature of Contractor to verify accuracy

Signature of Consultant

Signature of Contractor for receipt of monies

DAILY SITE ATTENDANCE REGISTER

Name of Contractor
Project Name

Project Number
Month:

1 = At Work
SL = Sick Leave
A = Absent
P = Public Holiday
L = Leave
2 = Training
SC = Site Closed

Validation: Cannot be more than 23 days per person per month.

	Surname	Initials	ID Number	Birth Date	Rate per day (R)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	**Total Work days**	**Total Training Days**	**Total work days & training days**
1																																					0	0	0
2																																					0	0	0
3																																					0	0	0
4																																					0	0	0
5																																					0	0	0
6																																					0	0	0
7																																					0	0	0
8																																					0	0	0
9																																					0	0	0
10																																					0	0	0
11																																					0	0	0
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13																																					0	0	0
14																																					0	0	0
15																																					0	0	0
16																																					0	0	0
17																																					0	0	0
18																																					0	0	0
19																																					0	0	0
20																																					0	0	0
20	**TOTALS**																													**TOTALS**							0	0	0

Signature of CLO

Week 1 -2: Signature of Contractor Organisation

Week 3-4: Signature of Contractor Organisation

Week 1: Signature of Contractor

Week 2: Signature of Contractor

Week 3: Signature of Contractor

Week 4: Signature of Contractor

Validation:		
	Total work days	0
	Total training days	0
	Total work days + training days	0
	Variance	0
	Variance must be 0	

BENEFICIARY LIST

Name of Contractor
Project Name
Project Number
Month:

Youth = 35yrs and less

Number of workers	Surname	Initials	Name	ID Number	Date of Birth	Male/Female	Has Disability (Y?N)	Is Youth (Y/N)	Education Level*	Date Start	Contact Number
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											

Signature of CLO

1. Actual EMPLOYMENT GENERATION

5.1. Actual Number of persons employed

Occupational Category			Adult				Youth				Disabled			
			Women		Men		Female		Male		Female		Male	
	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days
Clerical														
Labourer														
Managerial														
Semi-skilled														
Skilled														
Supervisor														
Total														

Please note: - The definition of youth is any person under the age of 35 years. (18-35 Years)
- Each person may only be counted once. If a person falls into more than one category, disabled persons take preference, then youth, then adults.
- Must include all occupational categories (Clerical, Labourer, Managerial, Semi-skilled, Skilled and Supervisor).

5.2. Average daily wage per category
Please note that the totals are calculated averages for the number of records submitted per category.

Occupational Category	Category Average	Adult		Youth		Disabled	
		Women	Men	Female	Male	Female	Male
		Daily wage	Daily wage	Daily wage	Daily wage	Daily wage	Daily wage
Clerical							
Labourer							
Managerial							
Semi-skilled							
Skilled							
Supervisor							
Average of the Daily Wage							

6. TRAINING ACTIVITIES

6.1 Non-Accredited Training

Training Type	Totals		Adult				Youth				Disabled			
			Women		Men		Female		Male		Female		Male	
	Persons Trained	Training days	Persons	Days	Persons	Days	Persons	Days	Persons	Days	Persons	Days	Persons	Days
Administration														
Technical														
Lifeskills/ ISD														
Literacy & Numeracy														
Vocational Skills														
Business Skills														
Total Training														

6.3 Accredited Training

Training Type	Totals		Adult				Youth				Disabled			
			Women		Men		Female		Male		Female		Male	
	Persons Trained	Training days	Persons	Days	Persons	Days	Persons	Days	Persons	Days	Persons	Days	Persons	Days
Administration														
Technical														
Lifeskills/ ISD														
Literacy & Numeracy														
Vocational Skills														
Business Skills														
Total Training														

6.4 Categories of Accreditation

Training Type	If Accredited		
	NSB Number	NQF Level	ETQA/ CETA
Administration			
Technical			
Lifeskills / ISD			
Literacy &Numeracy			
Vocational Skills			
Business Skills			
Total Training			

Note:
NQF Level of Training
Level 1 – General Education and Training
Level 2,3,4 - Further Education and Training
Level 5 - Higher Education and Training

NSB Number:
NSB 01: Agriculture and Nature Conservation
NSB 02: Culture and Arts
NSB 03: Business, Commerce and Management Studies
NSB 04: Communication Studies and Language
NSB 05: Education, Training and Development
NSB 06: Manufacturing, Employer's Agenting and Technology
NSB 07: Human and Social Studies
NSB 08: Law, Military Science and Security
NSB 09: Health Science and Social Services
NSB 10: Physical, Mathematical, Computer and Life Sciences
NSB 11: Services
NSB 12: Physical Planning and Construction

2. SMME'S USED SINCE THE START OF THE PROJECT:

Please remember to include all the SMME's that worked on the project since it started. Then add all the person days and all the funds paid to each SMME since the start of the project, and only record the latest total in the table.
For example, if a SMME completed all their work during the first reporting period, the name and details of that SMME must be added to every subsequent report.

SMME	Information about the SMME. (If it is a subsidiary: provide information for whole group and not for the SMME only)		Information about the work on the PROJECT			
Name of SMME	No. of permanent employees	Turnover previous 12 months	Total no. of person days to date	Amount paid to SMME to date. (Total)	Person days locally sourced: 0-25% 26-50% 51-75% 75-100%	Total value of work: SMME Involvement

7. BEE ORGANISATIONS USED SINCE THE START OF THE PROJECT:

Note that Black Economic Empowerment (BEE) Organisations are referred to in the table below as Affirmable Business Enterprises (ABE's).
The definition of an ABE is as per the Department of Public Works definition: ***A sole trader, partnership or legal entity which adheres to statutory labour practises, is registered with South African revenue Services and is a continuing and independent enterprise for profit, providing a commercially useful function and for which at least two thirds (67%) is owned by one or more PDI's and whose management and daily business operations are in control of one or more PDI's who effectively own it, and provided that the annual average turnover excluding VAT, does not exceed the maximum values given for each respective ABE category.***

Please remember to include all the ABE's that worked on the project since it started. Then add all the person days and all the funds paid to each ABE since the start of the project, and only record the latest

ABE	Information about the ABE. (If it is a subsidiary: provide information for whole group and not for the ABE only)		Information about the work on the PROJECT			
Name of ABE	No. of permanent employees	Turnover previous 12 months	Total no. of person days to date	Amount paid to ABE to date. (Total)	Person days locally sourced: 0-25% 26-50% 51-75% 75-100%	Total value of work: SMME Involvement

APPENDIX C: PEM ENVIRONMENTAL SPECS

APPENDIX D: PHS OHS SPECIFICATION

APPENDIX E: HIV/AIDS AWARENESS EDUCATION SPECIFICATION

APPENDIX F: BASELINE RISK ASSESSMENT

APPENDIX G: GEOTECHNICAL INVESTIGATION

APPENDIX H: RAINFALL DATA