14/4/2021

public works

Department:
Public Works
REPUBLIC OF SOUTH AFRICA

NATIONAL DEPARTMENT OF PUBLIC WORKS

VOLUME 1

TENDERING PROCEDURES, RETURNABLE DOCUMENTS, AGREEMENT AND CONTRACT DATA, SCOPE OF WORK AND SITE INFORMATION

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

TENDER NO: H21/ 001 AI

CLOSING DATE: 14th MAY 2021

Prepared for:

National Department of Public Works

Physical Address,
Central Government Offices
Cnr Bosman and Madiba
Pretoria
0001

Contact:
Name: Mr. Musawenkosi Mncwango
Telephone: 012 406 2150

Prepared by:

Endecon Ubuntu (Pty) Ltd.

Physical Address
257 Jean Avenue
Central Office Park
Building 6
Centurion
0157

Contact:
Name: Mr. Barend Venter – Pr.Eng, Pr.CPM
Telephone: 012 664 6770

Tenderer Name:

.....

CIDB Registration Number: ..... **CIDB Grade** .....

Total of the prices inclusive of value added tax:

R.....

Amount in words inclusive of value added tax:

.....

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

NATIONAL DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

Contents

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

PART T1: TENDERING PROCEDURES

TABLE OF CONTENTS **Colour**

PA-04 (EC): NOTICE AND INVITATION TO TENDER

THE DEPARTMENT OF PUBLIC WORKS INVITES TENDERS FOR:

Project title:	DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract
Reference no:	

Tender no:	H21/ 001 AI		
Advertising date:	19 April 2021	**Closing date:**	14 May 2021
Closing time:	11h00am	**Validity period:**	56**days**

It is estimated that tenderers should have a CIDB contractor grading designation of***6CE*** *or*
select tender value rangeselect class of construction works* or higher.
** Delete "or select tender value range select class of construction works" where only one class of construction works is applicable*

It is estimated that potentially emerging enterprises should have a CIDB contractor grading designation of
select tender value rangeselect class of construction works**PE***or*
select tender value rangeselect class of construction works**PE*** or higher.
** Delete "or select tender value range select class of construction works PE" where only one class of construction works is applicable*

Only tenderers who are responsive to the following responsiveness criteria are eligible to submit tenders. Failure to comply with the criteria stated hereunder shall result in the tender offer being disqualified from further consideration:

☒	Only those tenderers who satisfy the eligibility criteria stated in the Tender Data may submit tenders.
☒	Tender offer must be properly received on the tender closing date and time specified on the invitation, fully completed and signed in ink (All as per Standard Conditions of Tender).
☒	Submission of (DPW-07 EC): Form of Offer and Acceptance.
☒	Submission of (PA-11): Declaration of Interest and Tenderer's Past Supply Chain Management Practices.
☒	Submission of applicable (PA-15.1, PA-15.2, PA-15.3): Resolution by the legal entity, or consortium / joint venture, authorising a dedicated person(s) to sign documents on behalf of the firm / consortium / joint venture.
☒	Submission of (PA-29): Certificate of Independent Bid Determination.
☐	The tenderer will be required to submit his fully priced Bills of Quantities / Lump Sum Document (complete document inclusive of all parts) together with his tender.
☐	Submission of (DPW-16 EC): Site Inspection Meeting Certificate as proof of attendance of compulsory site inspection meeting. Due to COVID-19, No Compulsory Site Briefing.
☒	Use of correction fluid is prohibited
☒	Registration on National Treasury's Central Supplier Database (CSD)
☒	Compliance with Pre-qualification criteria for Preferential Procurement
☐	Compliance to Local Production and Content requirements as per PA36 and Annexure C
☒	Submission of (DPW-09EC) Particulars of Tender's Past Projects
☒	Submission of fully completed and duly signed (PA36 including Annexure C) Declaration Certificate for Local Production and Content of Designated Sector

☒	Submission of welders certificates (As per Functionality Criteria 4) If sub-contracting: 2) Provide proof of registration on National Treasury Central Supplier Database for all subcontractors listed in DPW-15 EC and in DPW-22 EC (Attach National Treasury Central Supplier Database Registration Printout)

Tenderer must comply with the Pre-qualification criteria for Preferential Procurement listed below

☒	A tenderer having stipulated minimum B-BBEE status level of contributor: ☒Level 1 ☒Level 2 ☐Level 3
☐	An EME or QSE
☐	A tenderer subcontracting a minimum of 30% to: ☐An EME or QSE which is at least 51% owned by black people ☐ An EME or QSE which is at least 51% owned by black people who are youth ☐An EME or QSE which is at least 51% owned by black people who are women ☐An EME or QSE which is at least 51% owned by black people with disabilities ☐An EME or QSE which is at least 51% owned by black people living in rural or underdeveloped areas or townships ☐A co-operative which is at least 51% owned by black people ☐An EME or QSE which is at least 51% owned by black people who are Military veterans ☐An EME or QSE;

This bid will be evaluated according to the preferential procurement model in the PPPFA:
(Tick applicable preference point scoring system)

☒ **80/20** Preference points scoring system	☐ **90/10** Preference points scoring system	☐**Either 80/20 or 90/10** Preference points scoring system

In case where below/above R 50 000 000 is selected, the lowest acceptable tender will be used to determine the applicable preference point system. (To be used in instances where the estimate cannot be reasonably determined or when one is unsure as to what the market price may be).

Note: *Functionality will be applied as a prequalification criterion. Such criteria is used to establish minimum requirements where after bids will be evaluated solely on the basis of price and preference.*

Minimum functionality score to qualify for further evaluation:	50

Functionality criteria:	**Weighting factor:**

1. COMPANY EXPERIENCE The Tenderer must provide a written submission about the company's construction experience specifically with reference to the number of comparable (nature and size) civil engineeering township services and pipeline projects successfully completed by the firm during the past five years. (References and contact details must be provided in the DPW 09 form) Service Provider to provide Letters of Appointment and Completion certificates of such projects. Letters of appointment and/or Completion certificates of such projects should be attached for points to be awarded Five or more successfully completed comparable civil engineering township services or pipeline projects = 5 Four successfully completed comparable civil engineering township services or pipeline projects = 4 Three successfully completed comparable civil engineering township services or pipeline projects = 3 Two successfully completed comparable civil engineering township services or pipeline projects = 2 One successfully completed comparable civil engineering township services or pipeline project = 1 No Information submitted = 0	30
2. KEY PERSONNEL The Tenderer must provide two key personnel within the firm with the CV's with the names, one Bsc and/or Btech or equivalent qualification and one NDip or Tradesman qualification with minimum 3 years experience for each. The two personnel will be permanently assigned to the project. NB: If any of the above Personnel are not in the Full-Time employment of the Bidder, the Bidder must submit a sworn affidavit that these or similar qualified personnel will be employed after the award of the Tender. Exceeding Fourteen years combined appropriate experience = 5 Exceeding Twelve but not exceeding Fourteen years combined appropriate experience = 4 Exceeding Ten but not exceeding Twelve years combined appropriate experience = 3 Exceeding Eight but not exceeding Ten years combined appropriate experience = 2 Exceeding Six but not exceeding Eight years combined appropriate experience = 1 No appropriate qualifications, less than 6 years combined appropriate experience, no affidavit provided (if required) or no information submitted = 0	30
3. FINANCIAL CAPABILITY The service provider to submit adequate financial resources. Original/Certified letter from the bank indicating the bank rating within 3 months from issued date Bank Rating of "A" = 5 Bank Rating of "B" = 4 Bank Rating of "C" = 3 Bank Rating of "D" = 2 Bank Rating of "E" = 1 No Bank rating provided = 0	20

4. Tenderers should name staff members that are qualified(Mersat Certified) to carry out specialised HDPE welding work on the pipeline works as described in this contract or Name specialist Subcontractor Company that the Tenderer will appoint to carry out the specialised HDPE welding work on the pipeline works as described in this contract and the names of the subcontractor staff that are qualified(Mersat Certified) NB: The specialist sub-contractor must be indicated on DPW-15 and CSD Report must be attached. Five Welders = 5 points Four Welders = 4 Points Three welders = 3 points Two welders = 2 points one welder = 1 point no submission = 0 points	20
Total	**100 Points**

This tender will be evaluated according to the preferential procurement model in the PPPFA in terms of points for price and preference as follows:

The formula:

$$W_C = W_3 \left[1 - \left(\frac{P - P_m}{P_m}\right)\right]$$

where
W_C = the number of tender evaluation points awarded for the financial offer
W_3 = the number of tender evaluation points for financial offer and equals:
1) 90 where the financial value inclusive of VAT of all responsive tenders received have a value in excess of R 50 000 000; or
2) 80 where the financial value inclusive of VAT of one or more responsive tender offers equals or is less than R 50 000 000

P_m = the lowest acceptable tender offer;
P = the tender offer under consideration.

Scoring Preferences:
Up to 100 minus W_3 tender evaluation points will be awarded to the tenderer who submits a valid original or certified copy of its B-BBEE Status Level Verification Certificate as described in more detail in the Tender Data (DPW-03 EC).

A consortium or joint venture will qualify for points for its B-BBEE status level only if such consortium or joint venture submits a consolidated B-BBEE status certificate which covers the consortium or joint venture as a combined unit as if it were a single enterprise.

Preference points will be allocated according to the following table:

B-BBEE Status Level of contributor	**Number of preference points, where W_3 :**	
	= 90	**= 80**
1	10	20
2	9	18

3	6	14
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

- In the case of Exempted Micro Enterprises (EME) and Qualifying Small Business Enterprise (QSE) a valid Sworn Affidavit must be submitted with the bid offer
- bidders other than EME or QSE must submit an original or certified copy of the B-BBEE Status Level Verification Certificate in order to qualify for preference points for B-BBEE
- A tender must submit of its proof of its B-BBEE status level of contributor
- A tender failing to submit proof of B-BBEE status level of contributor or is a non-compliant contributor to B-BBEE may not be disqualified
- A tenderer may not be awarded points for B-BBEE status level of contributor if the tender documents indicate that the tenderer intends subcontracting more than 25% of the tender value of the contract to any other person not qualifying for at least the points that the tenderer qualifies for; inless the intended subcontractor is an EME that has the capability to execute the subcontract

Collection of tender documents

☒ Bid documents are available for free download on e-Tender portal www.etenders.gov.za

☒ Alternatively; Bid documents may be collected during working hours at the following address CGO Building, Cnr Bosman & Madiba Street, Pretoria CBD**.** A non-refundable bid deposit of R 500 is payable, (Cash only) is required on collection of the bid documents.

Site inspection meeting

A pre-tender site inspection meeting will ***not be*** held in respect of this tender.
Attendance of said pre- tender site inspection meeting is ***not compulsory***

The particulars for said pre- tender site inspection meeting are:
Venue: N/A
Date: N/A
Starting time: N/A

Enquiries related to tender documents may be addressed to:

DPW Project Manager:	Musawenkosi Mncwango	**Telephone no:**	012 406 2150
Cell no:	073 648 6837	**Fax no:**	
E-mail:	musawenkosi.mncwango@dpw.gov.za		

Deposit / return of tender documents

Telegraphic, telephonic, telex, facsimile, electronic and / or late tenders will not be accepted.

Any reference to words “Bid” or Bidder” herein and/or in any other documentation shall be construed to have the same meaning as the words “Tender” or “Tenderer”.

Requirements for sealing, addressing, delivery, opening and assessment of tenders are stated in the Tender Data.

All tenders must be completed in ink and submitted on the official forms – (forms not to be re-typed).

Tender documents may be posted to:		**Deposited in the tender box at:**
The Director-General Department of Public Works Private Bag X65 Pretoria 0001 Attention: **Procurement section: Room** 121 ***POSTED TENDERS MUST BE RECEIVED PRIOR CLOSING DATE AND TIME AT 11:00 BY THE DEPARTMENT***	**OR**	Central Governement Offices (CGO) CGO Building - Entrance Foyer Corner Madiba & Bosman Street Room 121

Compiled by:

Musawenkosi Mncwango	MNCw	16/04/2024
Name of Project Manager	Signature	Date

DPW-03 (EC): TENDER DATA

Project title:	DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract
Reference no:	H21/ 001 AI

Tender no:	H21/ 001 AI	**Closing date:**	14 May 2021
Closing time:	11h00am	**Validity period:**	56**days**

Clause number:	
	The conditions of tender are the Standard Conditions of Tender as contained in Annex C of the CIDB Standard for Uniformity in Construction Procurement as per Government Notice No. 423 published in Government Gazette No. 42622 of 8 August 2019 and as amended from time to time. (see www.cidb.org.za). The Standard Conditions of Tender make several references to the Tender Data for details that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender. Each item of data given below is cross-referenced to the clause marked "C" in the above-mentioned Standard Conditions of Tender.
C.1.1	The employer is the Government of the Republic of South Africa in its Department of Public Works and Infrastructure.
C.1.2	For this contract the three-volume approach is adopted. This procurement document has been formatted and compiled under the headings as contained in the CIDB's "Standard for Uniformity in Construction Procurement." The three-volume procurement document issued by the employer comprises the following: Volume 1: Tendering procedures T1.1 - Notice and invitation to tender (PA-04 EC) T1.2 - Tender data (DPW-03 EC) Volume 2: Returnable documents T2.1 - List of returnable documents (PA-09 EC) C1.1 - Form of offer and acceptance (DPW-07 EC) C2.2 - Bills of Quantities / Lump sum document (if a returnable document) T2.2 - Returnable schedules Volume 3: Contract Part C1: Agreement and contract data C1.2 - Contract data (DPW-04 EC or DPW-05 EC) C1.3 - Form of guarantee (DPW-10.1 EC / DPW-10.3EC or DPW-10.2 EC/DPW-10.4 EC) Part C2: Pricing data C2.1 - Pricing instructions (PG-02.2 EC or PG-02.1EC) C2.2 - Bills of Quantities / Lump sum document (if not a returnable document) Part C3: Scope of work C3 - Scope of work (PG-01.2 EC or PG-01.1EC) Part C4: Site information C4 - Site information (PG-03.2 EC or PG03.1EC)

C.1.4	The Employer's agent is:	
	Name:	***Endecon Ubuntu (Pty) Ltd***
	Capacity:	***Engineer and Project Manager***
	Address:	***57 Jean Avenue*** ***Central Office Park*** ***Building 6*** ***Centurion*** ***0157***
	Tel:	***012 664 6770***
	Fax:	***012 643 0099***
	E-mail:	***barend@endecon.co.za***

C.2.1
C.3.11

A. <u>ELIGIBILITY IN RESPECT OF CIDB REGISTRATION</u>:

The following tenderers who are registered with the CIDB, or are *capable of being so registered prior to the evaluation of submissions, are eligible to have their tenders evaluated (* tenderers who are capable of being so registered, or who have applied for registration but have not yet received confirmation of such registration, must provide, <u>with this tender</u>, acceptable documentary proof thereof):

a) contractors who have a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations, for a ***CE*** or ***CE***** class of construction work; and
b) contractors registered as potentially emerging enterprises with the CIDB who are registered in one contractor grading designation lower than that required in terms of a) above

Joint ventures are eligible to submit tenders provided that:

1. every member of the joint venture is registered with the CIDB;
2. the lead partner has a contractor grading designation in the ***CE*** or ***CE***** class of construction work; and
3. the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered, or a value determined in accordance with Regulation 25 (1B) or 25 (7A) of the Construction Industry Development Regulations for a ***CE*** or ***CE***** class of construction work

** *Delete "or select tender value range select class of construction works" where only one class of construction works is applicable*

A contract will be entered into with a tenderer who has in his employ management and supervisory staff satisfying the requirements of the scope of work for labour intensive competencies for supervisory and management staff. - ***Not applicable***

B. <u>INDICATE THE FUNCTIONALITY WEIGHTING APPLICABLE TO THIS BID:</u>

<u>Note:</u> *Functionality will only be applied as a prequalification criterion. Such criteria are used to establish minimum requirements where after bids will be evaluated solely on the basis of price and preference.*

Functionality Criteria	***Weighting Factor***
1. COMPANY EXPERIENCE The Tenderer must provide a written submission about the company's construction experience specifically with reference to the number of comparable (nature and size) civil engineering township services and pipeline projects successfully completed by the firm during the past five years. (References and contact	**30**

details must be provided in the DPW 09 form) Service Provider to provide Letters of Appointment and Completion certificates of such projects. Letters of appointment and/or Completion certificates of such projects should be attached for points to be awarded Five or more successfully completed comparable civil engineering township services or pipeline projects = 5 Four successfully completed comparable civil engineering township services or pipeline projects = 4 Three successfully completed comparable civil engineering township services or pipeline projects = 3 Two successfully completed comparable civil engineering township services or pipeline projects = 2 One successfully completed comparable civil engineering township services or pipeline project = 1 No Information submitted = 0	
2. KEY PERSONNEL The Tenderer must provide two key personnel within the firm with the CV's with the names, one Bsc and/or Btech or equivalent qualification and one NDip or Tradesman qualification with minimum 3 years' experience for each. The two personnel will be permanently assigned to the project. NB: If any of the above Personnel are not in the Full-Time employment of the Bidder, the Bidder must submit a sworn affidavit that these or similar qualified personnel will be employed after the award of the Tender. Exceeding Fourteen years combined appropriate experience = 5 Exceeding Twelve but not exceeding Fourteen years combined appropriate experience = 4 Exceeding Ten but not exceeding Twelve years combined appropriate experience = 3 Exceeding Eight but not exceeding Ten years combined appropriate experience = 2 Exceeding Six but not exceeding Eight years combined appropriate experience = 1 No appropriate qualifications, less than 6 years combined appropriate experience, no affidavit provided (if required) or no information submitted = 0	**30**
. FINANCIAL CAPABILITY The service provider to submit adequate financial resources. Original/Certified letter from the bank indicating the bank rating within 3 months from issued date Bank Rating of "A" = 5 Bank Rating of "B" = 4 Bank Rating of "C" = 3 Bank Rating of "D" = 2 Bank Rating of "E" = 1 No Bank rating provided = 0	**20**
. Tenderers should name staff members that are qualified (Mersat Certified) to carry out specialised HDPE welding work on the pipeline works as described in this contract or	**20**

Name specialist Subcontractor Company that the Tenderer will appoint to carry out the specialised HDPE welding work on the pipeline works as described in this contract and the names of the subcontractor staff that are qualified (Mersat Certified) NB: The specialist sub-contractor must be indicated on DPW-15 and CSD Report must be attached. Five Welders = 5 points Four Welders = 4 Points Three welders = 3 points Two welders = 2 points one welder = 1 point no submission = 0 points	
Total	**100 Points**

(Weightings will be multiplied by the scores allocated during the evaluation process to arrive at the total functionality points)

Minimum functionality score to qualify for further evaluation:	**50**

(Total minimum qualifying score for functionality is 50 Percent).

C ELIGIBILITY IN RESPECT OF RISK TO EMPLOYER:

Standard risk management assessment criteria in respect of tenders received for routine projects in the engineering and construction works environment.

Tender offers will be evaluated by an Evaluation Committee based on the technical and commercial risk criteria listed hereunder. Each criterion carries the same weight / importance and will be evaluated individually based on reports presented to the Evaluation Committee by the Professional Team appointed on the project. A tender offer will be declared non-responsive and removed from any further evaluation if any one criterion is found to present an unacceptable risk to the Employer.

In order for the evaluation reports to be prepared by the Professional Team, the Tenderer is obliged to provide comprehensive information on form DPW-09 (EC). Failure to complete the said form will cause the tender to be declared non-responsive and removed from any further consideration. The Employer reserves the right to request additional information over and above that which is provided by the Tenderer on said form. The information must be provided by the Tenderer within the stipulated time as determined by the Project Manager, failing which the tender offer will *mutatis mutandis* be declared non-responsive.

C.1. Technical risks:

C.1.1 Criterion 1: Quality of current and previous work

Quality of current and previous work performed by the Tenderer in the class of construction work stated above as per the evaluation report prepared by the Professional Team, based on its research and inspection of a representative sample of the Tenderer's current and previous work as reflected on form DPW-09 (EC), as well as, if necessary, of any additional work executed by the Tenderer, not reflected on form DPW-09 (EC).

C.1.2 Criterion 2: Contractual commitment

Adherence to contractual commitments, demonstrated by the Tenderer in the performance on current and previous work, evaluated in terms of:
a) the level of progress on current projects in relation to the project programme or, if such is not available/applicable, to the contractual construction period in general;
b) the degree to which previous projects have been completed within the contractual completion periods and/or extensions thereto; and
c) general contract administration, i.e., compliance with contractual aspects such as laws and regulations, insurances, security, written contract instructions, subcontractors, time delay claims, etc as can generally be expected in standard/normal conditions of contract.

	C.2 Commercial risks: The level to which agreement with the Tenderer is reached in respect of the adjustment of rates which are considered to be imbalanced or unreasonable and to eliminate errors or discrepancies, without changing the tendered total price, over and above the correction of arithmetical errors as provided for in C.3.9.
C.2.7	For particulars regarding a pre-tender site inspection meeting, see Notice and Invitation to Tender T1.1
C.2.12	If a tenderer wishes to submit an alternative tender offer, the only criteria permitted for such alternative tender offer is that it demonstrably satisfies the Employer's standards and requirements. A tenderer may submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted. Provided that the tenderer's main tender offer is according to specification and would under normal circumstances be recommended for acceptance, his alternative tender offer may also be considered for the purpose of the award of the contract. Calculations, drawings and all other pertinent technical information and characteristics as well as modified or proposed Pricing Data must be submitted with the alternative tender offer to enable the Employer to evaluate the efficacy of the alternative and its principal elements, to take a view on the degree to which the alternative complies with the Employer's standards and requirements and to evaluate the acceptability of the pricing proposals. Calculations must be set out in a clear and logical sequence and must clearly reflect all design assumptions. Pricing Data must reflect all assumptions in the development of the pricing proposal. Acceptance of an alternative tender offer will mean acceptance in principle of the offer. It will be an obligation of the contract for the tenderer, in the event that the alternative is accepted, to accept full responsibility and liability that the alternative offer complies in all respects with the Employer's standards and requirements. The modified Pricing Data must include an amount equal to 5% of the amount tendered for the alternative offer to cover the Employer's costs of confirming the acceptability of the detailed design before it is constructed. Alternative tender offer permitted: **Yes** ☐ **No** ☒
C.2.13.2	The list of Returnable Documents identifies which of the documents a tenderer must complete when submitting a tender offer. The tenderer must submit his tender offer by completing the Returnable Documents, signing the "Offer" section in the "Form of Offer and Acceptance" and delivering the Returnable Documents back to the Department.
C.2.13.5	The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are as per Notice and Invitation to Tender T1.1.
C.2.13.6 **C.3.5**	A two-envelope procedure will not be followed.
C.2.15	The closing time for submission of tender offers is as per Notice and Invitation to Tender T1.1.
C.2.16	The tender offer validity period is as per Notice and Invitation to Tender T1.1.
C2.16.3	Omit the wording of the last sentence for those projects which are subject to CPAP
C.2.18	The tenderer will be required to submit his fully priced Bills of Quantities / Lump Sum Document (complete document inclusive of all parts): ☐ Together with his tender; or ☒ Within fourteen (14) calendar days of the date on which he has been requested to do so prior to the award of the contract.
C.2.19	Access shall be provided for inspections, tests and analysis as may be required by the Employer.
C.3.4.1 **C.3.4.2**	The location for opening of the tender offers, immediately after the closing time thereof shall be at: ***As per tender advertisement***
C.3.8	The words "responsive tender" and "acceptable tender" shall be construed to have the same meaning.

C.3.9.3	Omit the wording and replace with the following: "Notify the tenderer of all errors, omissions and/or rate imbalances that are identified in the tender offer and request the tenderer to, within a stipulated time, accept the total of prices as corrected in accordance with C.3.9.4."
C.3.9.4	Omit the wording of the first sentence and replace with the following: "In cases where tender offers contain errors, omissions and/or rate imbalances, these are to be corrected as follows:"
C.3.9.4	Add sub paragraph c) to C.3.9.4, as follows: "c) If the tenderer does not accept the corrected tender offer, or cannot reach consensus with the Employer on a corrected tender offer, the tender is to be classified as not acceptable/non responsive and removed from further contention."
C.3.11.1	The procedure for the evaluation of responsive tenders is Method 2: Financial Offer and Preference.
C.3.13	Add the following to sub paragraph a), as follows: The tenderer or any of its directors is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act, 2004 (Act No. 12 of 2004) as a person prohibited from doing business with the public sector;
C.3.17	Provide to the successful tenderer one copy of the signed contract document.

PART T2: RETURNABLE DOCUMENTS

TABLE OF CONTENTS

PA-09 (EC): LIST OF RETURNABLE DOCUMENTS

Project title:	***DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT***		
Tender / Quote no:	H21/ 001 AI	**Reference no:**	
Receipt Number:			

1. **RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES**

   Note: Failure to submit the applicable documents will result in the tender offer being disqualified from further consideration.

Tender document name	Number of pages issued	Returnable document
Form of Offer and Acceptance (DPW-07 EC)	4 Pages	Yes
Declaration of Interest and Tenderer's Past Supply Chain Management Practices (PA-11)	4 Pages	Yes
Submission of (PA-29): Certificate of Independent Bid Determination	4 Pages	Yes
Resolution of Board of Directors (PA-15.1) *(if applicable)*	1 Page	Yes
Resolution of Board of Directors to enter into Consortia or JV's (PA-15.2) *(if applicable)*	2 Pages	Yes
Special Resolution of Consortia or JV's (PA-15.3) *(if applicable)*	3 Pages	Yes
Site Inspection Meeting Certificate (DPW-16 EC) *(if applicable)*	1 Page	Yes
Particulars of Tenderer's Projects (DPW-09 EC)		
Proof of CSD Registration for tenderer and all sub-contarctors		Yes

2. **ADDITIONAL RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES**
   Note: Failure to submit the applicable documents will result in the Tenderer having to submit same upon request within a stipulated time and if not complied with, will result in the tender offer being disqualified from further consideration. [See also F.2.18 of the Standard Conditions of Tender]

Tender document name	Number of pages issued	Returnable document
Any additional information required to complete a risk assessment *(if applicable)*	-	Yes

3. **RETURNABLE DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT**
   Note: Failure to submit the applicable documents will result in the Tenderer having to submit same upon request within a stipulated time and if not complied with, will result in the tender offer being disqualified from further consideration. [See also F.2.18 of the Standard Conditions of Tender]

Tender document name	Number of pages issued	Returnable document
Record of Addenda to tender documents (DPW-21 EC) *(if applicable)*	1 Page	Yes
Schedule of proposed sub-contractors (DPW-15 EC) *(if applicable)*	1 Page	Yes

Particulars of Electrical Contractor (DPW-22 EC) *(if applicable)*	1 Page	Yes
Mechanical / Electrical / Security Work material and equipment schedules *(if applicable)*	Pages	Yes
Schedule for Imported Materials and Equipment (DPW-23 EC) *(if applicable)*	1 Page	Yes

4. OTHER DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

(Insert a tick in the "Returnable document" column to indicate which documents must be returned with the tender)

Note: Failure to submit the applicable documents will result in the tender offer being disqualified from further consideration.

Tender document name	Number of pages issued	Returnable document
Priced Bills of Quantities / Lump Sum Document (complete document inclusive of all parts)	Pages	☐Yes ☒No
insert document name	Pages	☐Yes ☒No
insert document name	Pages	☐Yes ☒No
insert document name	Pages	☐Yes ☒No
insert document name	Pages	☐Yes ☒No

5. ADDITIONAL INFORMATION THAT MAY BE REQUIRED FOR TENDER EVALUATION PURPOSES

Legal Status of Tendering Entity: **If the Tendering Entity is:**	**Documentation to be submitted with the tender, or which may be required during the tender evaluation:**
a. A close corporation, incorporated prior to 1 May 2011 under the Close Corporations Act, 1984 (Act 69 of 1984, as amended)	Copies of the Founding Statement – CK1
b. A profit company duly registered as a private company. [including a profit company that meets the criteria for a private company, whose Memorandum of Incorporation states that the company is a personal liability company in terms of Section 8(2)(c) of the Companies Act, 2008 (Act 71 of 2008, as amended)].	Copies of: i. Certificate of Incorporation – CM1; ii. Shareholding Certificates of all Shareholders of the company, plus a signed statement of the company's Auditor, certifying each Shareholder's ownership / shareholding percentage relative to the total; and/or iii. Memorandum of Incorporation in the case of a personal liability company.
c. A profit company duly registered as a private company in which any, or all, shares are held by one or more other close corporation(s) or company(ies) duly registered as profit or non-profit company(ies).	Copies of documents referred to in a. and/or b. above in respect of all such close corporation(s) and/or company(ies).
d. A profit company duly registered as a public company.	Copy of Certificate of Incorporation – CM1, and a signed statement of the company's Secretary or Auditor confirming that the company is a public company.

e. A non-profit company, incorporated in terms of Section 10 and Schedule 1 of the Companies Act, 2008 (Act 71 of 2008, as amended).	Copies of: i the Founding Statement – CK1; and ii the Memorandum of Incorporation setting out the object of the company, indicating the public benefit, cultural or social activity, or communal or group interest.
f. A natural person, sole proprietor or a Partnership	Copy(ies) of the Identity Document(s) of: i. such natural person/ sole proprietor, or each of the Partners to the Partnership.
g. A Trust	Deed of Trust duly indicating names of the Trustee(s) and Beneficiary (ies) as well as the purpose of the Trust and the mandate of the Trustees.

Signed by the Tenderer

Name of representative	**Signature**	**Date**

T2.2 RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES

PA-11: DECLARATION OF INTEREST AND BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

Failure to complete this form in <u>full</u> and signed by the duly authorized person, as indicated on PA-15.1 or PA-15.3, shall render the tender non-responsive and will be removed from any and all further contention.

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Bid no:	*H21/ 001 AI*	**Reference no:**	

The following particulars must be furnished. In the case of a joint venture, separate declarations in respect of each partner must be completed and submitted.

1. CIDB REGISTRATION NUMBER (if applicable)

2. Any legal person, including persons employed by the State[1]; or persons having a kinship with persons employed by the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes a price quotation, advertised competitive bid, limited bid or proposal). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the state, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her position in relation to the evaluating/adjudicating authority and/or take an oath declaring his/her interest, where:

- The bidder is employed by the state; and/or
- The legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declarant acts and persons who are involved with the evaluation and or adjudication of the bid.

3. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

3.1 Full Name of bidder or his or her representative: …….

3.2 Identity number:……

3.3 Position occupied in the Company (director, trustees, shareholder[2] ect ……

3.4 Company Registration Number: ……..……..

3.5 Tax Reference umber:..…….……

3.6 VAT Registration Number: ……....

3.6.1 The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / persal numbers must be indicated in paragraph 3 below.

[1] "State" means –

(a) any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No. 1 of 1999);
(b) any municipality or municipal entity;
(c) provincial legislature;
(d) national Assembly or the national Council of provinces; or
(e) Parliament.

[2] "Shareholder" means –

(a) a person who owns shares in the company and is actively involved in the management of the enterprise or business and exercise control over the enterprise

3.7 Are you or any person connected with the bidder presently employed by the state? ☐ YES ☐ NO

3.7.1 If so, furnish the following particulars:

Name of person / director /trustees/shareholder/ member:……..

Name of state institution at which you or the person

is connected to the bidder is employed ……...

Position occupied in the state institution:……

Any other particulars:

……

……

3.8 Did you or your spouse, or any of the company's directors / trustees/shareholders / members or their spouses conduct business with the state in the previous twelve months? ☐ YES ☐ NO

3.8.1 If so, furnish particulars:……

.....

3.9 Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid? ☐ YES ☐ NO

3.9.1 If so, furnish particulars.

……

……

3.10 Are you, or any person connected with the bidder, aware of any relationship (family, friend, other)

between the bidder and any person employed by the state who may be involved with the evaluation and or adjudication of this bid? ☐ YES ☐ NO

3.10.1 If so, furnish particulars.

……

……

3.11 Do you or any of the directors /trustees/shareholders/ members of the company have any interest in any other related companies whether or not they are bidding for this contract? ☐ YES ☐ NO

3.11.1 If so, furnish particulars:

……

……

4. Full details of directors / trustees / members / shareholders.

Full Name	**Identity Number**	**Personal Tax Reference Number**	**State Employee Number / Persal Number**

5. DECLARATION OF TENDERER / BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

5.1	*Is the tenderer / bidder or any of its directors listed on the National Treasury's database as companies or persons prohibited from doing business with the public sector?* **(Companies or persons who are listed on this database were informed in writing of this restriction by the National Treasury after the audi alteram partem rule was applied).**	☐ **Yes**	☐ **No**

5.2	*If so, furnish particulars:*		
5.3	*Is the tenderer / bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)?* **To access this Register enter the National Treasury's website, www.treasury.gov.za, click on the icon "Register for Tender Defaulters" or submit your written request for a hard copy of the Register to facsimile number (012) 3265445.**	☐ **Yes**	☐ **No**
5.4	*If so, furnish particulars:*		
5.5	*Was the tenderer / bidder or any of its directors convicted by a court of law (including a court outside of the Republic of South Africa) for fraud or corruption during the past five years?*	☐ **Yes**	☐ **No**
5.6	*If so, furnish particulars:*		
5.7	*Was any contract between the tenderer / bidder and any organ of state terminated during the past five years on account of failure to perform on or comply with the contract?*	☐ **Yes**	☐ **No**
5.8	*If so, furnish particulars:*		

6. CERTIFICATION

I the undersigned (full name) _____certify that the information furnished on this declaration form is true and correct.

I accept that, in addition to cancellation of a contract, action may be taken against me should this declaration prove to be false.

Name of Tenderer / bidder	Signature	Date	Position

This form has been aligned with SBD4 and SBD 8

PA- 29: CERTIFICATION OF INDEPENDENT BID DETERMINATION

Project title:	DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract		
Bid no:	H21/ 001 AI	**Reference no:**	

INTRODUCTION

1. This PA-29 [Certificate of Independent Bid Determination] must form part of all bids[1] invited.

2. Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).[2] Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.

3. Treasury Regulation 16A9 prescribes that accounting officers and accounting authorities must take all reasonable steps to prevent abuse of the supply chain management system and authorizes accounting officers and accounting authorities to:

    a. disregard the bid of any bidder if that bidder, or any of its directors have abused the institution's supply chain management system and or committed fraud or any other improper conduct in relation to such system.

    b. cancel a contract awarded to a supplier of goods and services if the supplier committed any corrupt or fraudulent act during the bidding process or the execution of that contract.

4. This form (PA-29) serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

5. In order to give effect to the above, the attached Certificate of Bid Determination (PA-29) must be completed and submitted with the bid:

---

[1] Includes price quotations, advertised competitive bids, limited bids and proposals.

[2] Bid rigging (or collusive bidding) occurs when businesses, that would otherwise be expected to compete, secretly conspire to raise prices or lower the quality of goods and / or services for purchasers who wish to acquire goods and / or services through a bidding process. Bid rigging is, therefore, an agreement between competitors not to compete.

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

in response to the invitation for the bid made by:

_____

(Name of Institution)

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: _____ that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate.

2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect.

3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder.

4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign the bid, on behalf of the bidder.

5. For the purposes of this Certificate and the accompanying bid, I understand that the word “competitor” shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:

(a) has been requested to submit a bid in response to this bid invitation;

(b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and

(c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder.

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium[3] will not be construed as collusive bidding.

7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

(a) prices;

(b) geographical area where product or service will be rendered (market allocation)

(c) methods, factors or formulas used to calculate prices;

(d) the intention or decision to submit or not to submit, a bid;

(e) the submission of a bid which does not meet the specifications and conditions of the bid; or

(f) bidding with the intention not to win the bid.

8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.

9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No

89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

[3] Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract.

Name of Bidder	Signature	Date	Position

PA-15.1: RESOLUTION OF BOARD OF DIRECTORS

RESOLUTION of a meeting of the Board of *Directors / Members / Partners of:

_____

(*legally correct full name and registration number, if applicable, of the Enterprise)*

Held at _____ (*place)*

on _____ *(date)*

RESOLVED that:

1. The Enterprise submits a Bid / Tender to the Department of Public Works in respect of the following project:

   _____

   (*project description as per Bid / Tender Document)*

   Bid / Tender Number: _____ *(Bid / Tender Number as per Bid / Tender Document)*

2. *Mr/Mrs/Ms: _____

   in *his/her Capacity as: _____ *(Position in the Enterprise)*

   and who will sign as follows: _____

   be, and is hereby, authorised to sign the Bid / Tender, and any and all other documents and/or correspondence in connection with and relating to the Bid / Tender, as well as to sign any Contract, and any and all documentation, resulting from the award of the Bid / Tender to the Enterprise mentioned above.

	Name	Capacity	Signature
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The bidding enterprise hereby absolves the Department of Public Works from any liability whatsoever that may arise as a result of this document being signed.

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must, where possible, be signed by <u>all</u> the Directors / Members / Partners of the Bidding Enterprise.*
3. *In the event that paragraph 2 cannot be complied with, the resolution must be signed by Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (attach proof of shareholding / ownership hereto).*
4. *Directors / Members / Partners of the Bidding Enterprise may alternatively appoint a person to sign this document on behalf of the Bidding Enterprise, which person must be so authorized by way of a duly completed power of attorney, signed by the Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (proof of shareholding / ownership and power of attorney are to be attached hereto).*
5. *Should the number of Directors / Members / Partners exceed the space available above, additional names and signatures must be supplied on a separate page.*

ENTERPRISE STAMP

PA-15.2: RESOLUTION OF BOARD OF DIRECTORS TO ENTER INTO CONSORTIA OR JOINT VENTURES

RESOLUTION of a meeting of the Board of *Directors / Members / Partners of:

_____

_____

(*Legally correct full name and registration number, if applicable, of the Enterprise)*

Held at _____ (*place)*

on _____ *(date)*

RESOLVED that:

1. The Enterprise submits a Bid /Tender, in consortium/Joint Venture with the following Enterprises:

   _____

   _____

   (List all the legally correct full names and registration numbers, if applicable, of the Enterprises forming the Consortium/Joint Venture)

   to the Department of Public Works in respect of the following project:

   _____

   _____

   (*Project description as per Bid /Tender Document)*

   Bid / Tender Number: _____ (*Bid / Tender Number as per Bid / Tender Document)*

2. *Mr/Mrs/Ms: _____

   in *his/her Capacity as: _____ *(Position in the Enterprise)*

   and who will sign as follows: _____

   be, and is hereby, authorised to sign a consortium/joint venture agreement with the parties listed under item 1 above, and any and all other documents and/or correspondence in connection with and relating to the consortium/joint venture, in respect of the project described under item 1 above.

3. The Enterprise accepts joint and several liability with the parties listed under item 1 above for the due fulfilment of the obligations of the joint venture deriving from, and in any way connected with, the Contract to be entered into with the Department in respect of the project described under item 1 above.

4. The Enterprise chooses as its *domicilium citandi et executandi* for all purposes arising from this joint venture agreement and the Contract with the Department in respect of the project under item 1 above:

   Physical address: _____

   _____

   _____

   _____ (code)

Resolution of Board of Directors to enter into Consortia or Joint Ventures: PA-15.2

Postal Address: _____

_____

_____

_____ (code)

Telephone number: _____

Fax number: _____

	Name	Capacity	Signature
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The bidding enterprise hereby absolves the Department of Public Works from any liability whatsoever that may arise as a result of this document being signed

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must, where possible, be signed by all the Directors / Members / Partners of the Bidding Enterprise.*
3. *In the event that paragraph 2 cannot be complied with, the resolution must be signed by Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (attach proof of shareholding / ownership hereto).*
4. *Directors / Members / Partners of the Bidding Enterprise may alternatively appoint a person to sign this document on behalf of the Bidding Enterprise, which person must be so authorized by way of a duly completed power of attorney, signed by the Directors / Members / Partners holding a majority of the shares / ownership of the Bidding Enterprise (proof of shareholding / ownership and power of attorney are to be attached hereto).*
5. *Should the number of Directors / Members / Partners exceed the space available above, additional names and signatures must be supplied on a separate page.*

ENTERPRISE STAMP

PA-15.3: SPECIAL RESOLUTION OF CONSORTIA OR JOINT VENTURES

RESOLUTION of a meeting of the duly authorised representatives of the following legal entities who have entered into a consortium/joint venture to jointly bid for the project mentioned below: (*legally correct full names and registration numbers, if applicable, of the Enterprises forming a Consortium/Joint Venture)*

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

7. _____

_____

8. _____

_____

Held at _____ (*place)*

on _____ *(date)*

RESOLVED that:

RESOLVED that:

A. The above-mentioned Enterprises submit a Bid in Consortium/Joint Venture to the Department of Public Works in respect of the following project:

_____

_____

(*Project description as per Bid /Tender Document)*

Bid / Tender Number: _____ (*Bid / Tender Number as per Bid /Tender Document)*

B. *Mr/Mrs/Ms: _____

in *his/her Capacity as: _____*(Position in the Enterprise)*

and who will sign as follows: _____

be, and is hereby, authorised to sign the Bid, and any and all other documents and/or correspondence in connection with and relating to the Bid, as well as to sign any Contract, and any and all documentation, resulting from the award of the Bid to the Enterprises in Consortium/Joint Venture mentioned above.

C. The Enterprises constituting the Consortium/Joint Venture, notwithstanding its composition, shall conduct all business under the name and style of:

_____

D. The Enterprises to the Consortium/Joint Venture accept joint and several liability for the due fulfilment of the obligations of the Consortium/Joint Venture deriving from, and in any way connected with, the Contract entered into with the Department in respect of the project described under item A above.

E. Any of the Enterprises to the Consortium/Joint Venture intending to terminate the consortium/joint venture agreement, for whatever reason, shall give the Department 30 days written notice of such intention. Notwithstanding such decision to terminate, the Enterprises shall remain jointly and severally liable to the Department for the due fulfilment of the obligations of the Consortium/Joint Venture as mentioned under item D above.

F. No Enterprise to the Consortium/Joint Venture shall, without the prior written consent of the other Enterprises to the Consortium/Joint Venture and of the Department, cede any of its rights or assign any of its obligations under the consortium/joint venture agreement in relation to the Contract with the Department referred to herein.

G. The Enterprises choose as the *domicilium citandi et executandi* of the Consortium/Joint Venture for all purposes arising from the consortium/joint venture agreement and the Contract with the Department in respect of the project under item A above:

Physical address: _____

_____

_____

_____ (code)

Postal Address: _____

_____

_____

_____ (code)

Telephone number: _____

Fax number: _____

	Name	Capacity	Signature
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The bidding enterprise hereby absolves the Department of Public Works from any liability whatsoever that may arise as a result of this document being signed.

Note:

1. ** Delete which is not applicable.*
2. ***NB:** This resolution must be signed by <u>all</u> the Duly Authorised Representatives of the Legal Entities to the consortium/joint venture submitting this tender, as named in item 2 of Resolution PA-15.2.*
3. *Should the number of the Duly Authorised Representatives of the Legal Entities joining forces in this tender exceed the space available above, additional names, capacity and signatures must be supplied on a separate page.*
4. *Resolution PA-15.2, duly completed and signed, from the separate Enterprises who participate in this consortium/joint venture, must be attached to this Special Resolution (PA-15.3).*

DPW-16 (EC): SITE INSPECTION MEETING CERTIFICATE

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	
Closing date:	*14 May 2021*		

This is to certify that I, _____representing

_____in the company of

_____ visited the site on: ***insert date***

I have made myself familiar with all local conditions likely to influence the work and the cost thereof. I further certify that I am satisfied with the description of the work and explanations given at the site inspection meeting and that I understand perfectly the work to be done, as specified and implied, in the execution of this contract.

Name of Tenderer	Signature	Date

Name of DPW Representative	Signature	Date

PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2017

This preference form must form part of all bids invited. It contains general information and serves as a claim form for preference points for Broad-Based Black Economic Empowerment (B-BBEE) Status Level of Contribution

NB: BEFORE COMPLETING THIS FORM, BIDDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017 AND THE AMENDED B-BBEE CODES.

---

1. GENERAL CONDITIONS

1.1. The following preference point systems are applicable to all bids:

- the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and
- the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).

1.2. The value of this bid is estimated to ***Not Exceed***R50 000 000 (all applicable taxes included) and therefore the…***80/20***……system shall be applicable.

1.3. Preference points for this bid shall be awarded for:

(a) Price; and
(b) B-BBEE Status Level of Contribution.

1.3.1 The maximum points for this bid are allocated as follows:

		POINTS
1.3.1.1	**PRICE**	***80***
1.3.1.2	**B-BBEE STATUS LEVEL OF CONTRIBUTION**	***20***
	Total points for Price and B-BBEE must not exceed	**100**

1.4. Failure on the part of a bidder to fill in and/or to sign this form and submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or an Accounting Officer as contemplated in the Close Corporation Act (CCA) together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.

1.5. An Exempted Micro Enterprise (EME) is only required to obtain a sworn affidavit or a certificate issued by Companies and intellectual property Commission (CIPC) confirming their annual turnover of R10 Million or less and level of black ownership to claim points.

1.6. Qualifying Small Enterprise (QSE) is only required to obtain a sworn affidavit or a certificate issued by Companies and intellectual property Commission (CIPC) confirming their annual turnover of R10 Million

or less and level of black ownership to claim points.

1.7 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

1.8 CERTIFICATES ISSUED BY IRBA AND ACCOUNTING OFFICER HAVE BEEN DISCONTINUED; HOWEVER VALID CERTIFICATES ALREADY ISSUED BEFORE 01 JANUARY 2017 MAY BE USED UNTIL THEY PHASE OUT COMPLETELY BY DECEMBER 2017

2. DEFINITIONS

(a) **"all applicable taxes"** includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;

(b) **"B-BBEE"** means broad-based black economic empowerment as defined in section 1 of the Broad-Based Black Economic Empowerment Act;

(c) "**B-BBEE status level of contributor"** means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

(d) **"bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of services, works or goods, through price quotations, advertised competitive bidding processes or proposals;

(e) **"Broad-Based Black Economic Empowerment Act"** means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(f) **"comparative price"** means the price after the factors of a non-firm price and all unconditional discounts that can be utilized have been taken into consideration;

(g) "consortium or joint venture" means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill and knowledge in an activity for the execution of a contract;

(h) **"contract"** means the agreement that results from the acceptance of a bid by an organ of state;

(i) "EME" means an Exempted Micro Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(j) **"Firm price"** means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs or excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;

(k) **"functionality"** means the measurement according to predetermined norms, as set out in the bid documents, of a service or commodity that is designed to be practical and useful, working or operating, taking into account, among other factors, the quality, reliability, viability and durability of a service and the technical capacity and ability of a bidder;

(l) **"non-firm prices"** means all prices other than "firm" prices;

(m) **"person"** includes a juristic person;

(n) **"QSE"** means a Qualifying Small Enterprise as defines by Codes of Good Practice under section 9 (1) of the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);

(o) **"rand value"** means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties;

*(p) **"sub-contract"** means the primary contractor's assigning, leasing, making out work to, or employing, another person to support such primary contractor in the execution of part of a project in terms of the contract;*

(q) **"total revenue"** bears the same meaning assigned to this expression in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act and promulgated in the *Government Gazette* on 9 February 2007;

(r) **"trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and

(s) **"trustee"** means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

3. ADJUDICATION USING A POINT SYSTEM

3.1 The bidder obtaining the highest number of total points will be awarded the contract.

3.2 Preference points shall be calculated after prices have been brought to a comparative basis taking into account all factors of non-firm prices and all unconditional discounts;.

3.3 Points scored must be rounded off to the nearest 2 decimal places.

3.4 In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of preference points for B-BBEE.

3.5 However, when functionality is part of the evaluation process and two or more bids have scored equal points including equal preference points for B-BBEE, the successful bid must be the one scoring the highest score for functionality.

3.6 Should two or more bids be equal in all respects, the award shall be decided by the drawing of lots.

4. POINTS AWARDED FOR PRICE

4.1 THE 80/20 OR 90/10 PREFERENCE POINT SYSTEMS

A maximum of 80 or 90 points is allocated for price on the following basis:

80/20 **or** **90/10**

$$Ps = 80\left(1 - \frac{Pt - P\min}{P\min}\right) \quad \text{or} \quad Ps = 90\left(1 - \frac{Pt - P\min}{P\min}\right)$$

Where

Ps = Points scored for comparative price of bid under consideration

Pt = Comparative price of bid under consideration

Pmin = Comparative price of lowest acceptable bid

5. Points awarded for B-BBEE Status Level of Contribution

5.1 In terms of Regulation 6(2) and /or 7(2), of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	6	14
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

5.2 A trust, consortium or joint venture, will qualify for points for their B-BBEE status level as a legal entity, provided that the entity submits their B-BBEE status level certificate.

5.3 A trust, consortium or joint venture will qualify for points for their B-BBEE status level as an unincorporated entity, provided that the entity submits their consolidated B-BBEE scorecard as if they were a group structure and that such a consolidated B-BBEE scorecard is prepared for every separate bid.

5.4 Tertiary institutions and public entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.

5.5 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.

6. BID DECLARATION

6.1 Bidders who claim points in respect of B-BBEE Status Level of Contribution must complete the following:

7. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.3.1.2 AND 5.1

7.1 B-BBEE Status Level of Contribution: …… = ……(maximum of 10 or 20 points)

(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 5.1 and must be substantiated by means of a B-BBEE certificate issued by a Verification Agency accredited by SANAS or Sworn Affidavit for EME's and QSE's.

8 SUB-CONTRACTING (relates to 5.5)

8.1 Will any portion of the contract be sub-contracted? YES / NO (delete which is not applicable)

8.1.1 If yes, indicate:

(i) what percentage of the contract will be subcontracted?
.....……%

(ii) the name of the sub-contractor? ……..

(iii) the B-BBEE status level of the sub-contractor?
……..

(iv) whether the sub-contractor is an EME/ a QSE? YES / NO (delete which is not applicable)

Designated Group: An EME or QSE which is at last 51% owned by:	EME √	QSE √
Black people		
Black people who are youth		
Black people who are women		
Black people with disabilities		
Black people living in rural or underdeveloped areas or townships		
Cooperative owned by black people		
Black people who are military veterans		
OR		
Any EME		
Any QSE		

9 DECLARATION WITH REGARD TO COMPANY/FIRM

9.1 Name of company/firm ..... :

9.2 VAT registration number :.....

9.3 Company registration number …….
:

9.4 TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One person business/sole propriety
- ☐ Close corporation
- ☐ Company
- ☐ (Pty) Limited

[TICK APPLICABLE BOX]

5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

……
……
……

9.6 COMPANY CLASSIFICATION

- ☐ Manufacturer
- ☐ Supplier
- ☐ Professional service provider
- ☐ Other service providers, e.g. transporter, etc.

[TICK APPLICABLE BOX]

9.7 Total number of years the company/firm has been in business? ……

9.8 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contribution indicated in paragraph 7 of the foregoing certificate/ Sworn Affidavit, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:

(i) The information furnished is true and correct;

(ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form.

(iii) In the event of a contract being awarded as a result of points claimed as shown in paragraph 7, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;

(iv) If the B-BBEE status level of contribution has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –

(a) Disqualify the person from the bidding process;

(b) Recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) Cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) restrict the bidder or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, from obtaining business from any organ of state for a period not exceeding 10 years, after the audi alteram partem (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution

WITNESSES:

1. ……

2. ……

……

SIGNATURE(S) OF BIDDER(S)

Preference Points Claim for Bids: PA-16

DATE:……..

ADDRESS:……..

……

public works & infrastructure
Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

PA- 40: DECLARATION OF DESIGNATED GROUPS FOR PREFERENTIAL PROCUREMENT

Name of Tenderer ……..…… ☐ **EME**[1] ☐ **QSE**[2] ☐ **Non EME/QSE (tick applicable box)**

1. **LIST ALL PROPRIETORS, MEMBERS OR SHAREHOLDERS BY NAME, IDENTITY NUMBER, CITIZENSHIP AND DESIGNATED GROUPS.**

Name and Surname #	Identity/ Passport number and Citizenship##	Percentage owned	Black	Indicate if youth	Indicate if woman	Indicate if person with disability	Indicate if living in Rural (R) / Under Developed Area (UD) / Township (T) / Urban (U).	Indicate if military veteran
1.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
2.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
3.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
4.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
5.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
6.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
7.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
8.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
9.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
10.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
11.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No
12.		%	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ R ☐ UD ☐ T ☐ U	☐ Yes ☐ No

\# Where Owners are themselves a Company, Close Corporation, Partnership etc, identify the ownership of the Holding Company, together with Registration number
\## State date of South African citizenship obtained (not applicable to persons born in South Africa)

[1] EME: Exempted Micro Enterprise
[2] QSE: Qualifying Small Business Enterprise

PA- 40: DECLARATION OF DESIGNATED GROUPS FOR PREFERENTIAL PROCUREMENT

2. DECLARATION:

The undersigned, who warrants that he/she is duly authorized to do so on behalf of the Tenderer, hereby confirms that:

1 The information and particulars contained in this Affidavit are true and correct in all respects;

2 The Broad-based Black Economic Empowerment Act, 2003 (Act 53 of 2003), Preferential Procurement Policy Framework Act, 2000 (Act 5 of 2000), the Preferential Procurement Regulations, 2017, National Small Business Act 102 of 1996 as amended and all documents pertaining to this Tender were studied and understood and that the above form was completed according to the definitions and information contained in said documents;

3 The Tenderer understands that any intentional misrepresentation or fraudulent information provided herein shall disqualify the Tenderer's offer herein, as well as any other tender offer(s) of the Tenderer simultaneously being evaluated, or will entitle the Employer to cancel any Contract resulting from the Tenderer's offer herein;

4 The Tenderer accepts that the Employer may exercise any other remedy it may have in law and in the Contract, including a claim for damages for having to accept a less favourable tender as a result of any such disqualification due to misrepresentation or fraudulent information provided herein;

5 Any further documentary proof required by the Employer regarding the information provided herein, will be submitted to the Employer within the time period as may be set by the latter;

Signed by the Tenderer

Name of representative	**Signature**	**Date**

DPW-09 (EC): PARTICULARS OF TENDERER'S PROJECTS

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender / quotation no:	H21/ 001 AI	**Closing date:**	14 May 2021
Advertising date:	19 April 2021	**Validity period:**	56 days

1. PARTICULARS OF THE TENDERER'S CURRENT AND PREVIOUS COMMITMENTS

1.1. Current projects

	Projects currently engaged in	Name of Employer or Representative of Employer	Contact tel. no.	Contract sum	Contractual commence-ment date	Contractual completion date	Current percentage progress
1							
2							
3							
4							
5							
6							
7							
8							

1.2. Completed projects

Projects completed in the previous 5 (five) years		**Name of Employer or Representative of Employer**	**Contact tel. no.**	**Contract sum**	**Contractual commence-ment date**	**Contractual completion date**	**Date of Certificate of Practical Completion**
1							
2							
3							
4							
5							
6							
7							
8							
9							

Name of Tenderer	Signature	Date

PA-36: DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND CONTENT FOR DESIGNATED SECTORS

This Standard Bidding Document (SBD) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

Before completing this declaration, bidders must study the General Conditions, Definitions, Directives applicable in respect of Local Content as prescribed in the Preferential Procurement Regulations, 2017, the South African Bureau of Standards (SABS) approved technical specification number SATS 1286:2011 (Edition 1) and the Guidance on the Calculation of Local Content together with the Local Content Declaration Templates [Annex C (Local Content Declaration: Summary Schedule), D (Imported Content Declaration: Supporting Schedule to Annex C) and E (Local Content Declaration: Supporting Schedule to Annex C)].

1. General Conditions

1.1. Preferential Procurement Regulations, 2017 (Regulation 8) make provision for the promotion of local production and content.

1.2. Regulation 8.(2) prescribes that in the case of designated sectors, organs of state must advertise such tenders with the specific bidding condition that only locally produced or manufactured goods, with a stipulated minimum threshold for local production and content will be considered.

1.3. Where necessary, for tenders referred to in paragraph 1.2 above, a two stage bidding process may be followed, where the first stage involves a minimum threshold for local production and content and the second stage price and B-BBEE.

1.4. A person awarded a contract in relation to a designated sector, may not sub-contract in such a manner that the local production and content of the overall value of the contract is reduced to below the stipulated minimum threshold.

1.5. The local content (LC) expressed as a percentage of the bid price must be calculated in accordance with the SABS approved technical specification number SATS 1286: 2011 as follows:

$$LC = [1 - x / y] * 100$$

Where
x is the imported content in Rand
y is the bid price in Rand excluding value added tax (VAT)

Prices referred to in the determination of x must be converted to Rand (ZAR) by using the exchange rate published by South African Reserve Bank (SARB) on the date of advertisement of the bid as indicated in paragraph 3.1 below.

PA36: Declaration Certificate for Local Production and Content for Designated Sectors.
(This form has been aligned with NT - SBD 6.2)

The SABS approved technical specification number SATS 1286:2011 is accessible on http:/www.thedti.gov.za/industrial development/ip.jsp at no cost.

1.6. A bid may be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation;

2. The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:

No.	Description of services, works or goods	Stipulated minimum threshold
1.	**Textile, clothing, leather and footwear**	
1.1	Overalls, hardhats and footwear	100%
1.2	General Personal Protective Equipment (PPE)	100%
2.	**Structural and Building**	
2.1	Cement concrete applications	100%
2.2	Structural steel reinforcement	100%
3.	**Plumbing, drainage and wet services**	
3.1	Sanitary ware: Water closets, wash hand basins, urinals and baths	100%
3.2	Sanitary ware and brassware	100%
3.3	Water meters	100%
3.4	Shut-off valves, strainers, non-return valves, expansion relief valves and safety valves	70%
3.5	Gate valves, non-return valves, air release valve and sluice gates	70%
4.	**Roads and stormwater drainage**	
4.1	Interlocking paving blocks	100%
4.2	Concrete paving blocks	100%
4.3	Barrier and semi-mountable kerbing	100%

3. Does any portion of the goods or services offered have any imported content?
(***Tick applicable box***)

YES		NO	

3.1 If yes, the rate(s) of exchange to be used in this bid to calculate the local content as prescribed in paragraph 1.5 of the general conditions must be the rate(s) published by SARB for the specific currency on the date of advertisement of the bid.

The relevant rates of exchange information is accessible on www.resbank.co.za

Indicate the rate(s) of exchange against the appropriate currency in the table below (refer to Annex A of SATS 1286:2011):

PA36: Declaration Certificate for Local Production and Content for Designated Sectors.
(This form has been aligned with NT - SBD 6.2)

Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

NB: Bidders must submit proof of the SARB rate (s) of exchange used.

4. Where, after the award of a bid, challenges are experienced in meeting the stipulated minimum threshold for local content the dti must be informed accordingly in order for the dti to verify and in consultation with the AO/AA provide directives in this regard.

LOCAL CONTENT DECLARATION (REFER TO ANNEX B OF SATS 1286:2011)

LOCAL CONTENT DECLARATION BY CHIEF FINANCIAL OFFICER OR OTHER LEGALLY RESPONSIBLE PERSON NOMINATED IN WRITING BY THE CHIEF EXECUTIVE OR SENIOR MEMBER/PERSON WITH MANAGEMENT RESPONSIBILITY (CLOSE CORPORATION, PARTNERSHIP OR INDIVIDUAL)

IN RESPECT OF BID NO. .....

ISSUED BY: (Procurement Authority / Name of Institution):
.....
NB

1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.

2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on http://www.thedti.gov.za/industrial_development/ip.jsp. Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. **Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below.** Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

I, the undersigned, ……..... (full names), do hereby declare, in my capacity as …… ……..
of .....(name of bidder entity), the following:

(a) The facts contained herein are within my own personal knowledge.

(b) I have satisfied myself that:

(i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS 1286:2011; and

(c) The local content percentage (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 3.1 above and the information contained in Declaration D and E which has been consolidated in Declaration C:

Bid price, excluding VAT (y)	R
Imported content (x), as calculated in terms of SATS 1286:2011	R
Stipulated minimum threshold for local content (paragraph 3 above)	
Local content %, as calculated in terms of SATS 1286:2011	

If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above.
The local content percentages for each product has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 3.1 above and the information contained in Declaration D and E.

(d) I accept that the Procurement Authority / Institution has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.

(e) I understand that the awarding of the bid is dependent on the accuracy of the information furnished in this application. I also understand that the submission of incorrect data, or data that are not verifiable as described in SATS 1286:2011, may result in the Procurement Authority / Institution imposing any or all of the remedies as provided for in Regulation 14 of the Preferential Procurement Regulations, 2017 promulgated under the Preferential Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

SIGNATURE:_____

WITNESS No. 1 _____ **DATE:** _____

WITNESS No. 2 _____ **DATE:** _____

SATS 1286.2011

Annex C

Local Content Declaration - Summary Schedule

(C1)	**Tender No.**
(C2)	**Tender description:**
(C3)	**Designated product(s)**
(C4)	**Tender Authority:**
(C5)	**Tendering Entity name:**
(C6)	**Tender Exchange Rate:**
(C7)	**Specified local content %**

Note: **VAT to be excluded from all calculations**

Pula | EU | GBP

Calculation of local content								Tender summary			
Tender item no's	**List of items**	**Tender price - each (excl VAT)**	**Exempted imported value**	**Tender value net of exempted imported content**	**Imported value**	**Local value**	**Local content % (per item)**	**Tender Qty**	**Total tender value**	**Total exempted imported content**	**Total Imported content**
(C8)	*(C9)*	*(C10)*	*(C11)*	*(C12)*	*(C13)*	*(C14)*	*(C15)*	*(C16)*	*(C17)*	*(C18)*	*(C19)*

(C20) **Total tender value**	**R 0**	
(C21) **Total Exempt imported content**		**R 0**
(C22) Total **Tender value net of exempt imported content**		**R 0**
(C23) **Total Imported content**		**R 0**
(C24) **Total local content**		**R 0**
(C25) **Average local content % of tender**		

Signature of tenderer from Annex B

Date: _____

Annex D

Imported Content Declaration - Supporting Schedule to Annex C

(D1)	**Tender No.**	
(D2)	**Tender description:**	
(D3)	**Designated Products:**	
(D4)	**Tender Authority:**	
(D5)	**Tendering Entity name:**	
(D6)	**Tender Exchange Rate:**	Pula

EU R 9.00 GBP R 12.00

Note: VAT to be excluded from all calculations

A. Exempted imported content

Tender item no's	Description of imported content	Local supplier	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Tender Qty	Exempted imported value
(D7)	*(D8)*	*(D9)*	*(D10)*	*(D11)*	*(D12)*	*(D13)*	*(D14)*	*(D15)*	*(D16)*	*(D17)*	*(D18)*

(D19) **Total exempt imported value** R 0

This total must correspond with Annex C - C 21

B. Imported directly by the Tenderer

Tender item no's	Description of imported content	Unit of measure	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Tender Qty	Total imported value
(D20)	*(D21)*	*(D22)*	*(D23)*	*(D24)*	*(D25)*	*(D26)*	*(D27)*	*(D28)*	*(D29)*	*(D30)*	*(D31)*

(D32) **Total imported value by tenderer** R 0

C. Imported by a 3rd party and supplied to the Tenderer

Description of imported content	Unit of measure	Local supplier	Overseas Supplier	Calculation of imported content: Forign currency value as per Commercial Invoice	Tender Rate of Exchange	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Summary: Quantity imported	Total imported value
(D33)	*(D34)*	*(D35)*	*(D36)*	*(D37)*	*(D38)*	*(D39)*	*(D40)*	*(D41)*	*(D42)*	*(D43)*	*(D44)*

(D45) **Total imported value by 3rd party** R 0

D. Other foreign currency payments

Type of payment	Local supplier making the payment	Overseas beneficiary	Calculation of foreign currency payments: Foreign currency value paid	Tender Rate of Exchange	Summary of payments: Local value of payments
(D46)	*(D47)*	*(D48)*	*(D49)*	*(D50)*	*(D51)*

(D52) **Total of foreign currency payments declared by tenderer and/or 3rd party**

Signature of tenderer from Annex B

(D53) **Total of imported content & foreign currency payments - *(D32), (D45) & (D52)* above** R 0

This total must correspond with Annex C - C 23

Date:

SATS 1286.2011

Annex E

Local Content Declaration - Supporting Schedule to Annex C

(E1)	**Tender No.**	
(E2)	**Tender description:**	
(E3)	**Designated products:**	
(E4)	**Tender Authority:**	
(E5)	**Tendering Entity name:**	

Note: **VAT to be excluded from all calculations**

Local Products (Goods, Services and Works)	Description of items purchased	Local suppliers	Value
	(E6)	*(E7)*	*(E8)*
		(E9) **Total local products (Goods, Services and Works)**	R 0

(E10) **Manpower costs** (Tenderer's manpower cost) R 0

(E11) **Factory overheads** (Rental, depreciation & amortisation, utility costs, consumables etc.) R 0

(E12) **Administration overheads and mark-up** (Marketing, insurance, financing, interest etc.) R 0

(E13) **Total local content** R 0

This total must correspond with Annex C - C24

Signature of tenderer from Annex B

Date: _____

T2.2 RETURNABLE DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

DPW-21 (EC): RECORD OF ADDENDA TO TENDER DOCUMENTS

Project title:	DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract		
Tender no:	H21/ 001 AI	**Reference no:**	

1. I / We confirm that the following communications received from the Department of Public Works and Infrastucture before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer: *(Attach additional pages if more space is required)*

	Date	Title or Details
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		

Name of Tenderer	Signature	Date

2. I / We confirm that no communications were received from the Department of Public Works and Infrastructure before the submission of this tender offer, amending the tender documents.

Name of Tenderer	Signature	Date

DPW-15 (EC): SCHEDULE OF PROPOSED SUBCONTRACTORS

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	

We notify you that it is our intention to employ the following Subcontractors for work in this contract.

We confirm that all subcontractors who are contracted to construct a house are registered as home builders with the National Home Builders Registration Council.

	Name and address of proposed Subcontractor	**Nature and extent of work**	**Previous experience with Subcontractor**
1			
2			
3			
4			
5			

Name of representative	**Signature**	**Capacity**	**Date**

Name of organisation:	

DPW-22 (EC): PARTICULARS OF ELECTRICAL CONTRACTOR

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	H21/ 001 AI	**Reference no:**	

Name of Electrical Contractor:	
Address:	
Electrical Contractor registration number at the Electrical Contracting Board of S.A.:	

Name of Tenderer	Signature	Date

DPW-23 (EC): SCHEDULE FOR IMPORTED MATERIALS AND EQUIPMENT

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	

This schedule should be completed by the tenderer. *(Attach additional pages if more space is required)*

Item	Material / Equipment	Rand (R) (Excluding VAT)
1.		**R**
2.		**R**
3.		**R**
4.		**R**
5.		**R**
6.		**R**

The Contractor shall list imported items, materials and/or equipment which shall be excluded from the Contract Price Adjustment Provisions (if applicable) and shall be adjusted in terms of currency fluctuations only. Copies of the supplier's quotations for the items, materials or equipment (provided that such costs shall not be higher than the relevant contract rate as listed above) should be lodged with the Principal Agent / Engineer of the Department of Public Works within 60 (sixty) days from the date of acceptance of the tender. No adjustment of the local VAT amount, nor the contractor's profit, discount, mark-up, handling costs, etc. shall be allowed.

These net amounts will be adjusted as follows:

FORMULA:

The net amount to be added to or deducted from the contract sum:

$$A = V\left(\frac{Z}{Y} - 1\right)$$

A = the amount (R) of adjustment

V = the net amount (supplier's quotation) (R) of the imported item

Y = exchange rate at the closing date of tender submission

Z = exchange rate on the date of payment.

Name of Tenderer	Signature	Date

T2.2 RETURNABLE DOCUMENTS: OTHER DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

THE CONTRACT

PART C1: AGREEMENT AND CONTRACT DATA

PART C2: PRICING DATA

PART C3: SCOPE OF WORK

PART C4: SITE INFORMATION

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

TABLE OF CONTENTS

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

C1.1 FORM OF OFFER AND ACCEPTANCE

DPW-07 (EC): FORM OF OFFER AND ACCEPTANCE

Project title:	DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract		
Tender no:	H21/ 001 AI	**Reference no:**	

OFFER

The Employer, identified in the acceptance signature block, has solicited offers to enter into a contract for the procurement of: DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

The Tenderer, identified in the offer signature block, has examined the documents listed in the tender data and addenda thereto as listed in the returnable schedules, and by submitting this offer has accepted the conditions of tender.

By the representative of the Tenderer, deemed to be duly authorized, signing this part of this form of offer and acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the conditions of contract identified in the contract data.

THE TOTAL OFFER INCLUSIVE OF ALL APPLICABLE TAXES (All applicable taxes" includes value- added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies) IS :

Rand (in words):	
Rand in figures:	**R**

The award of the tender may be subjected to further price negotiation with the preferred tenderer(s). The negotiated and agreed price will be considered for acceptance as ***a firm and final offer***.

This offer may be accepted by the Employer by signing the acceptance part of this form of offer and acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the tender data, whereupon the Tenderer becomes the party named as the Contractor in the conditions of contract identified in the contract data.

THIS OFFER IS MADE BY THE FOLLOWING LEGAL ENTITY: (cross out block which is not applicable)

Company or Close Corporation: …… …… And: Whose Registration Number is: …….. And: Whose Income Tax Reference Number is: …… CSD supplier number:……..	**OR**	Natural Person or Partnership: …….. …….. Whose Identity Number(s) is/are: …….. Whose Income Tax Reference Number is/are: …….. CSD supplier number:……..

AND WHO IS (if applicable)**:**

Trading under the name and style of: ……

AND WHO IS:

*Any reference to words "Bid" or "Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".
**Any reference to the words "payment reduction" herein shall be construed to have the same meaning as the word "retention"

Represented herein, and who is duly authorised to do so, by: Mr/Mrs/Ms: …… In his/her capacity as: ……	**Note:** **A Resolution / Power of Attorney, signed by all the Directors / Members / Partners of the Legal Entity must accompany this Offer, authorising the Representative to make this offer.**

Tender no: H21/ 001 AI

SIGNED FOR THE TENDERER:

Name of representative	Signature	Date

WITNESSED BY:

Name of witness	Signature	Date

This Offer is in respect of: (Please indicate with an "X" in the appropriate block)

The official documents …… ☐
The official alternative …… ☐

Own alternative (only if documentation makes provision therefore) .. ☐

(N.B.: Separate Offer and Acceptance forms are to be completed for the main and for each alternative offer)

SECURITY OFFERED:

(a) the Tenderer accepts that in respect of contracts up to R1 million, a payment reduction** of 5% of the contact value (excluding VAT) will be applicable and will be deducted by the Employer in terms of the applicable conditions of contract

(b) in respect of contracts above R1 million, the Tenderer offers to provide security as indicated below:

(1) cash deposit of 10 % of the Contract Sum (excluding VAT) **Yes** ☐ **No** ☐

(2) variable construction guarantee of 10 % of the Contract Sum (excluding VAT) ***select*** **Yes** ☐ **No** ☐

(3) payment reduction of 10% of the value certified in the payment certificate (excluding VAT) **Yes** ☐ **No** ☐

(4) cash deposit of 5% of the Contract Sum (excluding VAT) and a payment reduction of 5% of the value certified in the payment certificate (excluding VAT) **Yes** ☐ **No** ☐

(5) fixed construction guarantee of 5% of the Contract Sum (excluding VAT) and a payment reduction of 5% of the value certified in the payment certificate (excluding VAT) ***select*** **Yes** ☐ **No** ☐

NB. Guarantees submitted must be issued by either an insurance company duly registered in terms of the Short-Term Insurance Act, 1998 (Act 35 of 1998) or by a bank duly registered in terms of the Banks Act, 1990 (Act 94 of 1990) on the pro-forma referred to above. No alterations or amendments of the wording of the pro-forma will be accepted.

The Tenderer elects as its *domicilium citandi et executandi* in the Republic of South Africa, where any and all legal notices may be served, as (physical address):

……

Other Contact Details of the Tenderer are:

Telephone No…… Cellular Phone No. ……

*Any reference to words "Bid" or "Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".
**Any reference to the words "payment reduction" herein shall be construed to have the same meaning as the word "retention"

Fax No ……..

Postal address ……

Banker …… Branch……..

Registration No of Tenderer at Department of Labour …..……

CIDB Registration Number: ……...

Tender no: H21/ 001 AI

ACCEPTANCE

By signing this part of this form of offer and acceptance, the Employer identified below accepts the Tenderer's offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the conditions of contract identified in the contract data. Acceptance of the Tenderer's offer shall form an agreement between the Employer and the Tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract are contained in:
Part 1 Agreement and contract data, (which includes this agreement)
Part 2 Pricing data
Part 3 Scope of work
Part 4 Site information

and drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 to 4 above.

Deviations from and amendments to the documents listed in the tender data and any addenda thereto as listed in the tender schedules as well as any changes to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the schedule of deviations attached to and forming part of this agreement. No amendments to or deviations from said documents are valid unless contained in this schedule.

The Tenderer shall within two weeks after receiving a completed copy of this agreement, including the schedule of deviations (if any), contact the Employer's agent (whose details are given in the contract data) to arrange the delivery of any securities, bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the conditions of contract identified in the contract data. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the schedule of deviations (if any). Unless the tenderer (now contractor) within five (5) working days of the date of such receipt notifies the employer in writing of any reason why he/she cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the parties.

For the Employer:

Name of signatory	Signature	Date

Name of Organisation:	Department of Public Works and Infrastructure
Address of Organisation:	

WITNESSED BY:

*Any reference to words "Bid" or "Bidder" herein and/or in any other documentation shall be construed to have the same meaning as the words "Tender" or "Tenderer".
**Any reference to the words "payment reduction" herein shall be construed to have the same meaning as the word "retention"

Name of witness	Signature	Date

Tender no: H21/ 001 AI

Schedule of Deviations

1.1.1. Subject:
Detail:

1.1.2. Subject:
Detail:

1.1.3. Subject:
Detail:

1.1.4. Subject:
Detail:

1.1.5. Subject:
Detail:

1.1.6. Subject:
Detail:

By the duly authorised representatives signing this agreement, the Employer and the Tenderer agree to and accept the foregoing schedule of deviations as the only deviations from and amendments to the documents listed in the tender data and addenda thereto as listed in the tender schedules, as well as any confirmation, clarification or changes to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

*Any reference to words “Bid” or “Bidder” herein and/or in any other documentation shall be construed to have the same meaning as the words “Tender” or “Tenderer”.
**Any reference to the words “payment reduction” herein shall be construed to have the same meaning as the word “retention”

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

C1.2 CONTRACT DATA

DPW-05: (EC) CONTRACT DATA - (GCC (2010) 2nd EDITION: 2010)

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	

	PART 1: DATA PROVIDED BY THE EMPLOYER
	CONDITIONS OF CONTRACT
	The General Conditions of Contract for Construction Works, Second Edition, 2010, published by the South African Institution of Civil Engineering, Private Bag X200, Halfway House, 1685, is applicable to this Contract and is obtainable from *www.saice.org.za*

CONTRACT SPECIFIC DATA	
The following contract specific data, referring to the General Conditions of Contract for Construction Works, Second Edition, 2010, are applicable to this Contract:	
CLAUSES	**COMPULSORY DATA**
1.1.1.8	Amend Clause 1.1.1.8 to include the word "rights" to read as follows: "Contract Data" means the specific data which, together with these General Conditions of Contract, collectively describe the rights, risks, liabilities and obligations of the contracting parties and the procedures for the administration of the Contract.
1.1.1.13	Amend Clause 1.1.1.13 as follows, clarify when the defects liability period starts: "Defects Liability Period" means the period stated in the Contract Data, commencing on the date indicated on the Certificate of Completion or Certificates of Completion in the event of more than one Certificate of Completion is issued for different parts of the Works, during which the Contractor has both the right and the obligation to make good defects in the materials, Plant and workmanship covered by the Contract.
	Defects liability period is: **12 months**.
1.1.1.14 & 5.14.7	The time for achieving Practical Completion of the whole of the works is: ***9 months*** measured from the Commencement Date. The time thus stated includes special non-working days and the year-end break.
	or, if Practical Completion in portions is required, The times for achieving Practical Completion for the portions as set out in the Scope of Works are *mutatis mutandi*: For portion 1 within ***insert description as may be applicable*** For portion 2 within ***insert description as may be applicable*** For portion 3 within ***insert description as may be applicable*** For portion 4 within ***insert description as may be applicable*** *(followed by further portions as required)* The time for achieving Practical Completion of the whole of the Works is: ***9 months*, measured from the**

	Commencement Date. The time thus stated includes special non-working days and the year-end break.
1.1.1.15	The name of the Employer is: **The Government of the Republic of South Africa in its Department of Public Works.**
1.1.1.16	The name of the Engineer is: ***Endecon Ubuntu (Pty) Ltd***
1.1.1.26	The Pricing Strategy is a: **Re-measurement Contract**.
1.1.1.31	Not applicable to this Contract.
1.1.1.35	Insert the definition of "Value of Works" as Clause 1.1.1.35: "Value of Works" means the value of the Works certified by the Engineer as having been satisfactorily executed and shall include the value of the works done, the value of the materials and/or plant and Contract Price Adjustments.
1.2.1.2	**Employer's address:** Physical Address: ***Corner Bosman & Madiba (Vermeulen) Street*** ***Department of Public Works (CGO Building)*** ***Ground Floor, Room 121*** ***Pretoria*** ***0002*** Postal Address: ***Private Bag x65*** ***Pretoria*** ***0001*** Facsimile: ***086 540 3300*** Telephone: ***012 406 1134***
	Engineer's address: Physical Address: ***257 Jean Avenue*** ***Central Office Park*** ***Building 6*** ***Centurion*** ***0157*** Postal Address: ***P O Box 8197*** ***Centurion*** ***0046*** Facsimile: ***012 643 0099*** Telephone: ***012 664 6770***
1.3.4	Not applicable to this Contract.

1.3.5	Replace Clause 1.3.5 with the following provisions: (a) The Employer will become the owner of the information, documents, advice, recommendation and reports collected, furnished and/or compiled by the Contractor during the course of, and for the purposes of executing this Contract, all of which will be handed over to the Employer on request, but in any event on the termination and/or cancellation of this Contract for whatever reason. The Contractor relinquishes its retention or any other rights thereon to which it may be entitled. (b) The copyright of all documents, recommendations and reports compiled by the Contractor during the course of and for the purposes of finalizing the Works will vest in the Employer, and may not be reproduced or distributed or made available to any person outside the Employer's service, or to any institution in any way, without the prior written consent of the Employer. The Employer shall have the right to use such material for any other purpose without the approval of information or payment to the Contractor. (c) The copyright of all electronic aids, software programmes etc. prepared or developed in terms of the Contract shall vest in the Employer, who shall have the right to use such material for any other purpose without the approval of, information or payment to the Contractor. (d) In case of the Contractor providing documents, electronic aids, software programs or like material to the Employer, the development of which has not been at the expense of the Employer, copyright shall not vest in the Employer. The Contractor shall be required to indicate to which documents, electronic aids, software programs or like material this provision applies. (e) The Contractor hereby indemnifies the Employer against any action, claim, damages or legal cost that may be instituted against the Employer on the grounds of an alleged infringement of any copyright, patents or any other intellectual property right in connection with the Works outlined in this Contract. (f) All information, documents, recommendations, programs and reports collected or compiled must be regarded as confidential and may not be communicated or made available to any person outside the Employer's service and may not be published either during the currency of this Contract or after termination thereof without the prior written consent of the Employer.
3.1.3	1. The Engineer's authority to act and/or to execute functions or duties or to issue instructions are expressly **excluded** in respect of the following: (a) Appointment of nominated Sub-contractors – clause 4.4.3; (b) Granting of an extension of time and/or ruling on claims associated with claims for extension of time – clauses 5.12.3, 10.1.5; (c) Acceleration of the rate of progress and determination of the cost for payment of such acceleration – clause 5.12.4; (d) Rulings on claims and disputes – clauses 10.1.5, 10.2.3 and 10.3.3; (e) Suspension of the Works – clause 5.11.1; (f) Final Payment Certificate – clause 6.10.9; (g) Issuing of *mora* notices to the Contractor – clauses 9.1.1, 9.1.2.1 and 9.2.1; (h) Cancellation of the contract between the Employer and Contractor – clauses 9.1.1, 9.1.2.1 and 9.2.1.

	2. In order to be legally binding and have legal bearing and consequence, any ruling in respect of the above matters (a) to (h) must be on an official document, signed and issued by the Employer to the Contractor. 3. The Contractor must submit claims, demands, notices, notifications, updated particulars and reports in writing, as well as any other supporting documentation pertaining thereto, in respect of any of the above listed matters (a) to (h), to the Engineer within the time periods and in the format(s) as determined in the relevant clauses of the Conditions of Contract. Failing to deliver such to the Engineer timeous and in the correct format will invalidate any claim and the consequences of such failure will *mutatis mutandis* be as stated in clause 10.1.4. 4. Clauses 6.10.9 and 10.1.5 shall be amended as follows to indicate the limitation on the Engineer's authority in respect thereof: **Clause 6.10.9 – Amend to read as follows:** Within 14 days of the date of final approval as stated in the Final Approval Certificate, the Contractor shall deliver to the Engineer a final statement claiming final settlement of all moneys due to him (save in respect of matters in dispute, in terms of Clauses 10.3 to 10.11, and not yet resolved). The Employer shall within 14 days issue to the Contractor a Final Payment Certificate the amount of which shall be paid to the Contractor within 28 days of the date of such certificate, after which no further payments shall be due to the Contractor (save in respect of matters in dispute, in terms of Clauses 10.3 to 10.11 and not yet resolved). **Clause 10.1.5 – Amend to read as follows:** Unless otherwise provided in the Contract, the Employer shall, within 28 days after the Contractor has delivered his claim in terms of Clause 10.1.1 as read with Clause 10.1.2, deliver to the Contractor his written and adequately reasoned ruling on the claim (referring specifically to this Clause). The amount thereof, if any, allowed by the Employer shall be included to the credit of the Contractor in the next payment certificate. 5. Insert the following under 3.1.3: Provided that, notwithstanding any provisions to the contrary in the Contract, the Employer shall have the right to reverse and, should it deem it necessary, to amend any certificate, instruction, decision or valuation of the Engineer and to issue a new one, and such certificate instruction, decisions or valuations shall for the purposes of the Contract be deemed to be issued by the Engineer, provided that the Contractor shall be remunerated in the normal manner for work executed in good faith in terms of an instruction issued by the Engineer and which has subsequently been rescinded.
3.2.2.1	Amend Clause 3.2.2.1 to insert the word "Plant" to read as follows: Observe the execution of the Works, examine and test material, Plant and workmanship, and receive from the Contractor such information as he shall reasonably require.
3.2.3.2	Amend Clause 3.2.3.2 to insert the word "Plant" to reads as follows: Notwithstanding any authority assigned to him in terms of Clauses 3.2.2 and 3.2.4, failure by the Engineer's Representative to disapprove of any work, workmanship, Plant or materials shall not prejudice the power of the Engineer thereafter to disapprove thereof and exercise any of his powers in terms of the Contract in respect of thereof.
4.8.2.1	Amend Clause 4.8.2.1 to include the word "person", as follows: Makes available to the Employer, or to any such contractor, person or authority, any roads or ways for the maintenance of which the Contractor is responsible, or
4.8.2.2	Amend Clause 4.8.2.2 to include "Employer" and "contractors", as follows:

	Provides any other facility or service of whatsoever nature to the Employer or to any of the said contractors, persons or authorities,
5.3.1	The documentation required before commencement with Works execution are: Health and Safety Plan (Refer to Clause 4.3) Initial programme (Refer to Clause 5.6) Security (Refer to Clause 6.2) Insurance (Refer to Clause 8.6) ***insert other requirements*** ***insert other requirements*** ***insert other requirements***
5.3.2	The time to submit the documentation required before commencement with Works execution is: **21 days.**
5.4.2	The access to, and possession of, the Site referred to in Clause 5.4.1 shall be ***enter "exclusive" or "not exlcusive"*** to the Contractor. In the event of access to, and possession of, the Site is not exclusive to the Contractor, the following limitations apply: ***Insert an exposition of limitation.***
5.8.1	The non-working days are: **Saturdays and Sundays**
	The special non-working days are: **(1) Public Holidays;** **(2) The year-end break commencing on 16 December until the Sunday preceding the first working Monday of January of the succeeding year.**
5.9.1	Amend Clause 5.9.1 as follows: On the Commencement Date, the Engineer shall deliver to the Contractor three (3) copies, at no cost to the Contractor, of the drawings and any instructions required for the commencement of the Works. The cost of any additional copies of such drawings and/or instructions, as may be required by the Contractor, will be for the account of the Contractor.
5.13.1	The penalty for failing to complete the Works is: **R*3643.43 (incl. VAT)* per day**
	or, if completion in portions is required, The penalty for failing to complete portion 1 of the Works is: **R*Insert penalty amount* per day**. The penalty for failing to complete portion 2 of the Works is: **R*Insert penalty amount* per day**. The penalty for failing to complete portion 3 of the Works is: **R*Insert penalty amount* per day**. The penalty for failing to complete portion 4 of the Works is: **R*Insert penalty amount* per day**. *Followed by further portions as required*. The penalty for failing to complete the whole of the works is: **R*3643.43 (incl. VAT)* per day**.
5.14.1	Amend the second paragraph of Clause 5.14.1 as follows: When the Works are about to reach the said stage, the Contractor shall, in writing, request a Certificate of Practical Completion and the Engineer shall, within 14 days after receiving such request, issue to the Contractor a written list setting out the work to be completed to justify Practical Completion. Should the Engineer not issue such a list within the 14 days, the Contractor shall notify the Employer accordingly.

	Should the Employer not issue such a list within 7 days of receipt of such notice, Practical Completion shall be deemed to have been achieved on the 14th day after the contractor requested the Certificate of Practical Completion.
5.16.1	Amend Clause 5.16.1 to delete the proviso in the third paragraph of this clause.
5.16.2	Amend Clause 5.16.2 as follows: No certificate other than the Final Approval Certificate referred to in Clause 5.16.1 shall be deemed to constitute approval of the Works or shall be taken as an admission of the due performance of the Contract or any part thereof, nor of the accuracy of any claim made by the Contractor, nor shall any other certificate exclude or prejudice any of the powers of the Engineer and/or the Employer.
5.16.3	The latent defect period for all works is: **5 years**.
6.2.1	The type of security for the due performance of the Contract, as selected by the Contractor in the Contract Data, must be delivered to the Employer.
6.2.3	Amend Clause 6.2.3 as follows: If the Contractor has selected a performance guarantee as security, he shall ensure that it remains valid and enforceable as required in terms of the Contract.
6.5.1.2.3	The percentage allowance to cover overhead charges is: **33%, except on material cost where the percentage allowance is 10%.**
6.8.2	Contract Price Adjustment (CPA) will be applicable: ***No***. If CPA is indicated as 'Yes" above the value of payment certificates is to be adjusted by a Contract Price Adjustment Factor: The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule with the following values: The value of "x" is 0.15. The values of the coefficients are: a = 0.25. (Labour) b = 0.3 (Contractor's equipment) c = 0.3 (Material) d = 0.15 (Fuel) The values of the coefficients for "Repair and Maintenance Project" (RAMP) contracts are: a = 0.35 (Labour) b = 0.20 (Contractor's equipment) c = 0.35 (Material) d = 0.10 (Fuel) The urban area nearest the Site is ***Pretoria***. *(Select urban area from Statistical News Release, P0141, Table 7.1.)* The applicable industry for the Producer Price Index for materials is ***N/A***. *(Select the applicable industry from Statistical News Release, P01421, Table 11.)* The area for the Producer Price Index for fuel is ***N/A***. *(Select the area from Statistical News Release, P01421, Table 12.)* The base month is ***the month prior to the closing of the tender*** *20**21**. (The month prior to the*

	closing of the tender.)
6.8.3	Price adjustments for variations in the costs of special materials are not allowed.
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is: **85 %**.
6.10.3	The limit of retention money is dependent on the security to be provided by the Contractor in terms of Clause 6.2.1.
6.10.5	Replace Clause 6.10.5 with the following: In respect of contracts up to R2 million and in respect of contracts above R2 million where the Contractor elects a security by means of a 10% retention, 50% of the retention shall be released to the Contractor when the Engineer issues the Certificate of Completion in terms of clause 5.14.4. The remaining 50% of the retention shall be released in accordance with the provisions of the conditions of contract and will become due and payable when the Contractor becomes entitled, in terms of Clause 5.16.1, to receive the Final Approval Certificate. In respect of contracts above R2 million, where the Contractor elects a security by means of a cash deposit or fixed guarantee of 5% of the Contract Sum (excl. VAT) and a 5% retention of the Value of the Works (excl. VAT), the cash deposit or fixed guarantee, whichever is applicable, shall be refunded to the Contractor or return to the guarantor, respectively, when the Engineer issues the Certificate of Completion in terms of Clause 5.14.4. The 5% retention of the Value of the Works (excl. VAT) shall become due and payable when the Contractor becomes entitled, in terms of Clause 5.16.1, to receive the Final Approval Certificate. In respect of contracts above R2 million, where the Contractor elects a security by means of a cash deposit or a variable guarantee of 10% of the Contract Sum (excl. VAT), the cash deposit or the variable guarantee, whichever is applicable, will be reduced to 5% of the Value of the Works (excl. VAT) when the Engineer issues the Certificate of Completion in terms of Clause 5.14.4. The balance of the cash deposit shall become due and payable or the variable guarantee shall expire when the Contractor becomes entitled in terms of Clause 5.16.1 to receive the Final Approval Certificate.
7.9.1	Insert the following at the end of Clause 7.9.1: Provided that, should the Contractor on demand not pay the amount of such costs to the Employer, such amount may be determined and deducted by the Employer from any amount due to or that may become due to the Contractor under this or any other previous or subsequent contract between the Contractor and the Employer.
8.2.2.1	Insert the following as a second paragraph to Clause 8.2.2.1: The Contractor shall at all times proceed immediately to remove or dispose of any debris arising from damage to or destruction of the Works and to rebuild, restore, replace and/or repair the Works, failing which the Employer may cause same to be done and recover the reasonable costs associated therewith from the Contractor.
8.4.3	Insert a new Clause 8.4.3 as follows: The Contractor shall on receiving a written instruction from the Engineer immediately proceed at his own cost to remove or dispose of any debris and to rebuild, restore, replace and/or repair such property and to execute the Works.
8.6.1.1.1	Amend Clause 8.6.1.1.1 to read as follows: Contract Sum plus 10%.
8.6.1.1.2	The value of Plant and materials supplied by the Employer to be included in the insurance sum is: **Nil**

8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is: **Nil**
8.6.1.3	Amend Clause 8.6.1.3 to delete reference to limit of indemnity, to read as follows: Liability insurance that covers the Contractor against liability for the death of, or injury to any person, or loss of, or damage to any property (other than property while it is insured in terms of Clause 8.6.1.1) arising from or in the course of the fulfillment of the Contract, from the Commencement Date to the date of the end of the Defects Liability Period, if there is one, or otherwise to the issue of the Certificate of Completion.
8.6.1.5	1. **Public liability insurance** to be effect by the Contractor to a minimum value of: ☒ R5 million **or** ☐ R ***insert amount in figures (and in words)*** With a deductible not exceeding 5% of each and every claim. 2. **Support insurance** is to be effected by the Contractor to a minimum value of: R ***zero*** With a deductible not exceeding 5% of each and every claim.
8.6.5	Amend Clause 8.6.5 as follows: Save as otherwise provided in the Contract Data, the insurances referred to in Clause 8.6.1 shall be effected with an insurance company registered in the Republic of South Africa. The Contractor shall submit the insurance policy to the Employer for approval, if so requested.
8.6.7	Amend Clause 8.6.7 as follows: If the Contractor fails to effect and keep in force any of the insurances referred to in Clause 8.6.1, the Employer may cancel the Contract in terms of Clause 9.2.
8.6.8	Insert a new Clause 8.6.8 in provide for high risk insurance for projects executed on areas classified as "High Risk Areas". **HIGH RISK INSURANCE** In the event of the project being executed in a geological area classified as a "High Risk Area", that is an area which is subject to highly unstable subsurface conditions that might result in catastrophic ground movement evident by sinkhole or doline formation the following will apply: (1) **Damage to the Works** The Contractor shall, from the date of Commencement of the Works until the date of the Certificate of Completion, bear the full risk of and hereby indemnifies and holds harmless the Employer against any damage to and/or destruction of the Works consequent upon a catastrophic ground movement as mentioned above. The Contractor shall take such precautions and security measures and other steps for the protection of the Works as he may deem necessary. When so instructed to do so by the Engineer, the Contractor shall proceed immediately to remove and/or dispose of any debris arising from damage to or destruction of the Works and to rebuild, restore, replace and/or repair the Works, at the Contractor's own costs. (2) **Injury to Persons or Loss of or damage to Properties**

	The Contractor shall be liable for and hereby indemnifies and holds harmless the Employer against any liability, loss, claim or proceeding arising during the Contract Period whether arising in common law or by Statute, consequent upon personal injuries to or the death of any person whomsoever resulting from, arising out of or caused by a catastrophic ground movement as mentioned above. The Contractor shall be liable for and hereby indemnifies the Employer against any and all liability, loss, claim or proceeding consequent upon loss of or damage to any moveable, or immovable or personal property or property contiguous to the Site, whether belonging to or under the control of the Employer or any other body or person whomsoever arising out of or caused by a catastrophic ground movement, as mentioned above, which occurred during the Contract Period. (3) It is the responsibility of the Contractor to ensure that he has adequate insurance to cover his risk and liability as mentioned in Clauses 8.6.8(1) and 8.6.8 (2) above. Without limiting his obligations in terms of the Contract, the Contractor shall, within 21 days of the Commencement Date and before Commencement of the Works, submit to the Employer proof of such insurance policy, if requested to do so. (4) The Employer shall be entitled to recover any and all losses and/or damages of whatever nature suffered or incurred consequent upon the Contractor's default of his obligations as set out in Clauses 8.6.8 (1), 8.6.8 (2) and 8.6.8 (3). Provided that, should the Contractor on demand not pay the amount of such costs to the Employer, such amount may be determined and deducted by the Employer from any amount due to or that may become due to the Contractor under this or any other existing or subsequent contract between the Contractor and the Employer.
9.1.4	Amend Clause 9.1.4 as follows: In the circumstances referred to in Clauses 9.1.1, 9.1.2 or 9.1.3 (provided that the circumstances in 9.1.3 is not due to the fault of the Contractor, his employees, contractors or agents), and whether or not the Contract is terminated under the provisions of this Clause, the Contractor shall be entitled to payment of any increased cost of or incidental to the execution of the Works which is specifically attributable to, or consequent upon the circumstances defined in Clauses 9.1.1, 9.1.2 or 9.1.3;
9.1.5	Amend Clause 9.1.5 as follows: If the Contract is terminated on any account in terms of this Clause (provided that the circumstances in 9.1.3 is not due to the fault of the Contractor, his employees, contractors or agents) , the Contractor shall be paid by the Employer (insofar as such amounts or items have not already been covered by payments on account made to the Contractor) for all measured work executed prior to the date of termination, the amount (without retention), payable in terms of the Contract and, in addition:
9.1.6	This Clause is not applicable to this Contract.
9.2.1.3.8	Insert a new Clause 9.2.1.3.8 as follows: Has failed to effect and keep in force any of the insurances referred to in Clause 8.6.1,
9.2.4	Insert a new Clause 9.2.4 as follows, to provide for unilateral termination by the Employer: The Employer shall be entitled at any time to unilaterally terminate or cancel this Contract or any part thereof. Save for the following, the Contractor shall not be entitled to claim any other amounts whatsoever in respect of such termination or cancellation of this Contract. The Employer shall be obliged to pay the Contractor as damages and/or loss of profit the lesser of: 9.2.4.1 An amount not exceeding 10% of the Contract Sum; 9.2.4.2 10% of the value of incomplete work; or 9.2.4.3 The Contractor's actual damage or loss as determined by the Employer after receipt of evidence

	substantiating any such damage or loss.
9.3.2.2	Amend Clause 9.3.2.2 as follows to delete the proviso on lien: The ownership of Plant and unused materials brought onto the Site by the Contractor, and for which the Employer has not made any payment, shall revest to the Contractor and he shall, with all reasonable dispatch, remove from the Site such Plant, materials and all Construction Equipment and Temporary Works.
9.3.3	Insert the following at the end of Clause 9.3.3 After cancellation of the Contract by the Contractor, the Contractor, when requested by the Employer to do so, shall not be entitled to refuse to withdraw from the Works on the grounds of any lien or a right of retention or on the grounds of any other right whatsoever.
10.1.3.1	Amend Clause 10.1.3.1 as follows to insert the word "Plant": All facts and circumstances relating to the claims shall be investigated as and when they occur or arise. For this purpose, the Contractor shall deliver to the Engineer, records in a form approved by the Engineer, of all the facts and circumstances which the Contractor considers relevant and wishes to rely upon in support of his claims, including details of all Construction Equipment, labour, Plant and materials relevant to each claim. Such records shall be submitted promptly after the occurrence of the event giving rise to the claim.
10.1.6	Insert a new Clause 10.1.6 as follows: If the Employer fails to give his ruling within the period referred to in Clause 10.1.5 he shall be deemed to have given a ruling dismissing the claim.
10.2.1	Amend Clause 10.2.1 as follows: In respect of any matter arising out of or in connection with the Contract, which is not required to be dealt with in terms of Clause 10.1 or which does not require the decision or ruling of the Employer, the Contractor or the Employer shall have the right to deliver a written dissatisfaction claim to the Engineer. This written claim shall be supported by particulars and substantiated.
10.2.2	Amend Clause 10.2.2 as follows: If, in respect of any matter arising out of or in connection with the Contract, which is not required to be dealt with in terms of Clause 10.1 or which does not require the decision or ruling of the Employer, the Contractor or the Employer fails to submit a claim within 28 days after the cause of dissatisfaction, he shall have no further right to raise any dissatisfaction on such matter.
10.3.2	Amend Clause 10.3.2 as follows to replace "adjudication" with "court": If either party shall have given notice in compliance with Clause 10.3.1, the dispute shall be referred to court proceedings in terms of Clause 10.8, unless amicable settlement is contemplated.
10.3.3	Replace "Engineer" with "Employer".
10.4.2	Amend Clause 10.4.2 as follows to provide for submission to court: If the other party rejects the invitation to amicable settlement in writing or does not respond in writing to the invitation with 14 days, or amicable settlement is unsuccessful, either party may submit the dispute to court.
10.4.4	Amend Clause 10.4.4 to delete reference to "adjudication" and "arbitration" to read as follows: Save for reference to any portion of any settlement or decision which has been agreed to be final and binding on the parties, no reference shall be made by or on behalf or either party in any subsequent court proceedings, to any outcome of an amicable settlement, or to the fact that any particular evidence was

	given, or to any submission, statement or admission made in the course of the amicable settlement.
10.5 10.6 & 10.7	The entire provisions of these Clauses are not applicable to this Contract.
10.10.3	Amend Clause 10.10.3 as follows to reword and remove reference to "arbitrator": The court shall have full power to open up, review and revise any ruling, decision, order, instruction, certificate or valuation of the Engineer and Employer and neither party shall be limited in such proceedings before such court to the evidence or arguments put before the Engineer or Employer for the purpose of obtaining his ruling.

	PART 2: DATA PROVIDED BY THE CONTRACTOR
1.1.1.9	The name of the Contractor is: ***Insert legal name of Contractor***
1.2.1.2	The address of the Contractor is: Physical Address: ***insert physical address*** ***insert town*** ***insert code*** Postal Address: ***insert postal address*** ***insert town*** ***insert postal code*** Facsimile: ***insert fax no*** Telephone: ***insert tel no***
6.2.1	The security to be provided by the Contractor shall be one of the following: (a) Cash deposit of 10 % of the Contact Sum (excl. VAT) ☐ **YES** or ☐ **NO** (b) Variable performance guarantee of 10 % of the Contract Sum (excl. VAT) ☐ **YES** or ☐ **NO** (c) Retention of 10 % of the value of the Works (excl. VAT) ☐ **YES** or ☐ **NO** (d) Cash deposit of 5 % of the Contract Sum (excl. VAT) plus retention of 5 % of the value of the Works (excl. VAT) ☐ **YES** or ☐ **NO** (e) Performance guarantee of 5 % of the Contract Sum (excl. VAT) plus retention of 5 % of the value of the Works (excl. VAT) ☐ **YES** or ☐ **NO** ***NB: Guarantees submitted must be issued by either an insurance company duly registered in terms of the Short-Term Insurance Act, 1998 (Act 53 of 1998) or by a bank duly registered in terms of the Banks Act, 1990 (Act 94 of 1990) on the pro-forma referred to above. No alterations or amendments of the wording of the pro-forma will be accepted.***

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

C1.3 FORM OF GUARANTEE

DPW-10.2 (EC): VARIABLE CONSTRUCTION GUARANTEE – (GCC (2010) 2nd EDITION: 2010)

Director-General
Department of Public Works
Government of the Republic of South Africa

To: ***insert name***
Private Bag ***insert no***
insert town
insert postal code

Sir,

VARIABLE CONSTRUCTION GUARANTEE FOR THE EXECUTION OF A CONTRACT IN TERMS OF GCC (2010) 2nd EDITION 2010

1. With reference to the contract between _____

   _____ (hereinafter referred to as the **"contractor"**) and the Government of the Republic of South Africa in its Department of Public Works (hereinafter referred to as the **"employer"**), Contract/Tender No: ***H20/ 002 AI***, for the ***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract*** (hereinafter referred to as the **"contract"**) for the sum of R ***insert amount***, (***insert amount in words***), (hereinafter referred to as the **"contract sum"**).

   I / We, _____

   in my/our capacity as _____ and hereby

   representing _____ (hereinafter referred to as the **"guarantor"**) advise that the **guarant**or holds at the **employer**'s disposal the sum of R ***insert amount***, (***insert amount in words***) being 10% of the **contract sum** (excluding VAT), for the due fulfilment of the **contract**.

2. I / We advise that the **guaranto**r's liability in terms of this guarantee shall be as follows:

   (a) From and including the date on which this guarantee is issued and up to and including the day before the date on which the last **certificate of completion** of works is issued, the **guarantor** will be liable in terms of this guarantee to the maximum amount of 10% of the **contract sum** (excluding VAT);

   (b) The **guarantor**'s liability shall reduce to 5 % of the **value of the works** (excluding VAT) as determined at the date of the last **certificate of completion** of works, subject to such amount not exceeding 10% of the **contract sum** (excluding VAT);

   (c) This guarantee shall expire on the date of the last **final approval certificate**.

3. The **guarantor** hereby renounces the benefits of the exceptions *non numeratae pecunia; non causa debiti; excussionis et divisionis;* and *de duobus vel pluribus reis debendi* which could be pleaded against the enforcement of this guarantee, with the meaning and effect whereof I/we declare myself/ourselves to be conversant, and undertake to pay the **employer** the amount guaranteed on receipt of a written demand from the **employer** to do so, stating that (in the **employer**'s opinion and sole discretion):

   (a) the **contractor** has failed or neglected to comply with the terms and/or conditions of the **contract**; or
   (b) the **contractor**'s estate is sequestrated, liquidated or surrendered in terms of the insolvency laws in force within the Republic of South Africa.

4. Subject to the above, but without in any way detracting from the **employer**'s rights to adopt any of the procedures provided for in the **contract**, the said demand can be made by the **employer** at any stage prior to the expiry of this guarantee.
5. The amount paid by the **guarantor** in terms of this guarantee may be retained by the **employer** on condition that upon issue of the last **final approval certificate**, the **employer** shall account to the **guarantor** showing how this amount has been expended and refund any balance due to the **guarantor**.

6. The **employer** shall have the absolute right to arrange his affairs with the **contractor** in any manner which the **employer** deems fit and the **guarantor** shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the **guarantor**. Without derogating from the aforegoing, any compromise, extension of the construction period, indulgence, release or variation of the **contractor**'s obligation shall not affect the validity of this guarantee.

7. The **guarantor** reserves the right to withdraw from this guarantee at any time by depositing the guaranteed amount with the **employer**, whereupon the **guarantor**'s liability ceases.

8. This guarantee is neither negotiable nor transferable, and

   (a) must be surrendered to the **guarantor** at the time when the **employer** accounts to the **guarantor** in terms of clause 5 above, or
   (b) shall lapse in accordance with clause 2 (c) above.

9. This guarantee shall not be interpreted as extending the **guarantor**'s liability to anything more than payment of the amount guaranteed.

SIGNED AT _____ ON THIS _____ DAY OF

_____ 200__

AS WITNESS

1. _____

2. _____

_____

By and on behalf of

_____

_____

_____

(insert the name and physical address of the guarantor)

NAME: _____

CAPACITY: _____
(duly authorised thereto by resolution attached marked Annexure A)

DATE: _____

A. No alterations and/or additions of the wording of this form will be accepted.

B. The physical address of the guarantor must be clearly indicated and will be regarded as the guarantor's *domicilium citandi et executandi,* for all purposes arising from this guarantee.

C. This GUARANTEE must be returned to: _____

_____

DPW-10.4 (EC): FIXED CONSTRUCTION GUARANTEE - (GCC (2010) 2nd EDITION: 2010)

Director-General
Department of Public Works
Government of the Republic of South Africa

To: ***insert name***
Private Bag ***insert no***
insert town
insert postal code

Sir,

FIXED CONSTRUCTION GUARANTEE FOR THE EXECUTION OF A CONTRACT IN TERMS OF GCC (2010) 2ND EDITION 2010

1. With reference to the contract between _____

   _____ (hereinafter referred to as the "**contractor"**) and the Government of the Republic of South Africa in its Department of Public Works (hereinafter referred to as the **"employer"**), Contract/Tender No: ***H20/ 002 AI***, for the ***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract*** (hereinafter referred to as the **"contract"**), for the sum of R ***insert amount***, (***insert amount in words***), (hereinafter referred to as the **"contract sum"**).

   I / We, _____

   in my/our capacity as _____and hereby

   representing _____ (hereinafter referred to as the "**guarantor"**) advise that the **guarantor** holds at the e**mployer**'s disposal the sum of R ***insert amount***, (***insert amount in words***) being 5% of the **contract sum** (excluding VAT), for the due fulfillment of the **contract**.

2. The **guarantor** hereby renounces the benefits of the exceptions *non numeratae pecunia; non causa debiti; excussionis et divisionis;* and *de duobus vel pluribus reis debendi* which could be pleaded against the enforcement of this guarantee, with the meaning and effect whereof I/we declare myself/ourselves to be conversant, and undertake to pay the **employer** the amount guaranteed on receipt of a written demand from the **employer** to do so, stating that (in the **employer**'s opinion and sole discretion):

   (a) the **contractor** has failed or neglected to comply with the terms and/or conditions of the **contract**; or
   (b) the **contractor**'s estate is sequestrated; liquidated or surrendered in terms of the insolvency laws in force within the Republic of South Africa.

3. Subject to the above, but without in any way detracting from the **employer**'s rights to adopt any of the procedures provided for in the **contract**, the said demand can be made by the **employer** at any stage prior to the expiry of this guarantee.

4. The amount paid by the **guarantor** in terms of this guarantee may be retained by the **employer** on condition that upon the issue of the last **final approval certificate**, the **employer** shall account to the **guarantor** showing how this amount has been expended and refund any balance due to the **guarantor**.

5. The **employer** shall have the absolute right to arrange his affairs with the **contractor** in any manner which the **employer** deems fit and the **guarantor** shall not have the right to claim his release on account of any conduct alleged to be prejudicial to the **guarantor**. Without derogating from the

aforegoing, any compromise, extension of the construction period, indulgence, release or variation of the **contractor**'s obligation shall not affect the validity of this guarantee.

6. The **guarantor** reserves the right to withdraw from this guarantee at any time by depositing the guaranteed amount with the **employer**, whereupon the **guarantor**'s liability ceases.

7. This guarantee is neither negotiable nor transferable, and

   (a) must be surrendered to the **guarantor** at the time when the **employer** accounts to the **guarantor** in terms of clause 4 above, or

   (b) shall lapse on the date of the last **certificate of completion** of works.

8. This guarantee shall not be interpreted as extending the **guarantor**'s liability to anything more than the payment of the amount guaranteed.

SIGNED AT _____ ON THIS _____ DAY OF

_____ 20____.

AS WITNESS

1. _____

2. _____

_____

By and on behalf of

_____

_____

_____

(insert the name and physical address of the guarantor)

NAME: _____

CAPACITY: _____
(duly authorised thereto by resolution attached marked Annexure A)

DATE: _____

A. No alterations and/or additions of the wording of this form will be accepted.

B. The physical address of the guarantor must be clearly indicated and will be regarded as the guarantor's *domicilium citandi et executandi,* for all purposes arising from this guarantee.

C. This GUARANTEE must be returned to: _____

_____

PG-02.1 (EC) PRICING INSTRUCTIONS – (GCC (2010) 2nd EDITION: 2010)

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	

C2.1 Pricing Instructions

1. GENERAL

The Bill of Quantities forms part of the Contract Documents and must be read and priced in conjunction with all the other documents comprising the Contract Documents, which include the Conditions of Tender, Conditions of Contract, the Specifications (including the Standard, Project and Particular Specifications) and the Drawings.

2. DESCRIPTION OF ITEMS IN THE SCHEDULE

The Bill of Quantities has been drawn up generally in accordance with Civil Engineering Quantities 1990 issued by the SA Institution of Civil Engineers.

The short descriptions of the items in the Bill of Quantities are for identification purposes only and the measurement and payment clause of the Standardized Specifications and the Particular Specifications, read together with the relevant clauses of the Project Specification and directives on the drawings, set out what ancillary or associated work and activities are included in the rates for the operations specified.

3. QUANTITIES REFLECTED IN THE SCHEDULE

The quantities given in the Bill of Quantities are estimates only, and subject to remeasuring during the execution of the work. The Contractor shall obtain the Engineer's detailed instructions for all work before ordering any materials or executing work or making arrangements for it.

The Works as finally completed in accordance with the Contract shall be measured and paid for as specified in the Bill of Quantities and in accordance with the General and Special Conditions of Contract, the Standard, Project and Particular Specifications and the Drawings. Unless otherwise stated, items are measured net in accordance with the Drawings, and no allowance has been made for waste.

The validity of the contract will in no way be affected by differences between the quantities in the Bill of Quantities and the quantities finally certified for payment.

4. PROVISIONAL SUMS

Where Provisional sums or Prime Cost sums are provided for items in the Bill of Quantities, payment for the work done under such items will be made in accordance with Clause 6.6 of the General Conditions of Contract 2010. The Employer reserves the right, during the execution of the works, to adjust the stated amounts upwards or downwards according to the work actually done under the item, or the item may be omitted altogether, without affecting the validity of the Contract.

The Tenderer shall not under any circumstances whatsoever delete or amend any of the sums inserted in the "Amount" column of the Bill of Quantities and in the Summary of the Bill of Quantities unless ordered or authorized in writing by the Employer before closure of tenders. Unauthorized changes made by the Tenderer to provisional items in the Bill of Quantities, or to the provisional percentages and sums in the Summary of the Bill of Quantities will lead to the disqualification of the Tenderer.

5. PRICING OF THE BILL OF QUANTITIES

The prices and rates to be inserted by the Tenderer in the Bill of Quantities shall be the full inclusive prices to be paid by the Employer for the work described under the several items, and shall include full compensation for all costs and expenses that may be required in and for the completion and maintenance during the defects liability period of all the work described and as shown on the drawings

as well as all overheads, profits, incidentals and the cost of all general risks, liabilities and obligations set forth or implied in the documents on which the Tender is based.

Tender no:

Each item shall be priced and extended to the "Total' column by the Tenderer, with the exception of the items for which only rates are required, or items which already have Prime Cost or Provisional Sums affixed thereto. If the Tenderer omits to price any items in the Bill of Quantities, then these items will be considered to have a nil rate or price.

All items for which terminology such as "inclusive" or "not applicable" have been added by the Tenderer will be regarded as having a nil rate which shall be valid irrespective of any change in quantities during the execution of the Contract.

The Tenderer shall fill in rates for all items where the words "rate only' appear in the "Total" column. "Rate Only" items have been included where:

(a) an alternative item or material is contemplated;

(b) variations of specified components in the make-up of a pay item may be expected; and

(c) no work under the item is foreseen at tender stage but the possibility that such work may be required is not excluded.

For 'Rate Only" items no quantities are given in the "Quantity" column but the quoted rate shall apply in the event of work under this item being required. The Tenderer shall however note that in terms of the Tender Data the Tenderer may be asked to reconsider any such rates which the Employer may regard as unbalanced.

All rates and amounts quoted in the Bill of Quantities shall be in rands and cents and shall include all levies and taxes (other than VAT). VAT will be added in the summary of the Bill of Quantities.

The Tenderer shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself before submitting his tender (as far as is practicable) as to:

(a) the form and nature of the Site and its surroundings, including subsurface conditions,

(b) the hydrological and climatic conditions,

(c) the extent and nature of work and materials necessary for the execution and completion of the Works,

(d) the means of access to the Site and the accommodation he may require

and, in general, shall be deemed to have obtained all information (as far as is practicable) as to risks, contingencies and all other circumstances which may influence or affect his Tender.

6. CORRECTION OF ENTRIES

Incorrect entries shall not be erased or obliterated with correction fluid but must be crossed out neatly. The correct figures must be entered above or adjacent to the deleted entry, and the alteration must be initialled by the Tenderer.

7. ARITHMETICAL ERRORS

Arithmetical errors found in the Bill of Quantities as a result of faulty multiplication or addition, will be corrected by the Engineer at the tender evaluation stage, as set out in the Tender Data.

Tender no:

8. UNITS OF MEASUREMENT

The units of measurement described in the Bill of Quantities are metric units for which the standard international abbreviations are used. Non-standard abbreviations which may appear in the Bill of Quantities are as follows:

No.	=	Number
%	=	Percent
Sum	=	Lump sum
PCsum	=	Prime cost sum
Prov sum	=	Provisional sum
m^3.km	=	Cubic metre - kilometre
Km-pas	=	kilometre - pass
m^2.pass	=	square metre – pass

Tender no:

C2.1 Bill of Quantities

Insert Bill of Quantities

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

NATIONAL DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

C2.2 BILL OF QUANTITIES

DEPARTMENT OF PUBLIC WORKS - REPUBLIC OF SOUTH AFRICA
DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT
TENDER NUMBER: H21/ 001 AI
SECTION 1: PRELIMINARY AND GENERAL

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 A	**SECTION 1: PRELIMINARY AND GENERAL**				
	PSA 8.2.1	**FIXED- CHARGE AND VALUE-RATED ITEMS**				
	SANS 1200 A					
1.1.0.0	**8.3.1**	**CONTRACTUAL REQUIREMENTS** Contractor to notice requirements regarding High Risk Insurance (see DPW-05: EC Contract Data - GCC 2010) to cover plant and personnel working in or around sinkholes and trench excavations in a dolomitic High Risk area. See Special Conditions of Contract. Contractor to execute work with safety requirements as per General and Particular Specifications of this document. The ocupational Health & Safety Act compliance for parts of the work is the responsibility of the contractor.	sum	1		
1.2.0.0	**8.3.2**	**PROVISION OF FACILITIES ON SITE**				
1.2.1.0	**8.3.2.1**	**FACILITIES FOR ENGINEER**				
1.2.1.1	8.3.2.1(a)	Telephone (cellphone), Internet(Wi-fi) and photo copy machine.	sum	1		
1.2.1.2	8.3.2.1(c)	Name board (no 2)	sum	1		
1.2.2.0	**8.3.2.2**	**FACILITIES FOR CONTRACTOR**				
1.2.2.1	8.3.2.2 (a to i)	All facilities, tools, laboratory and services as per own requirements. (Additional: Telephone and facsimile facility must be provided). Special plant are covered in respective bills	sum	1		
1.3.0.0	8.3.3	General responsibilities and other fixed charged obligations	sum	1		
1.4.0.0	8.3.3	Site safety regarding working near sinkholes and dolines (See PS3)	sum	1		
1.5.0.0	8.3.4	Removal of site establishment	sum	1		
	PSA 8.2.2	**TIME-RELATED ITEMS**				
	SANS 1200 A					
1.6.0.0	**8.4.1**	**CONTRACTUAL REQUIREMENTS**	sum	1		
1.7.0.0	**8.4.2**	**OPERATE AND MAINTAIN FACILITIES ON SITE**				
1.7.1.0	**8.4.2.1**	**FACILITIES FOR ENGINEER**	sum	1		
1.7.2.0	**8.4.2.2**	**FACILITIES FOR CONTRACTOR**				
1.7.2.1	8.4.2.2 (a to i)	All facilities, tools, laboratory and services as per own requirements. (Additional: Telephone and wi-fi facility must be provided). Special plant are covered in respective bills	sum	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
1.8.0.0	**PSA 8.2.3**	**DIRECT SUPERVISION OF WORKS** Special requirement: The Contractor is to provide full time construction supervision by a written appointed construction supervisor for work in or around sinkholes and dolines. This person shall at no time leave the site during such construction activities.				
1.9.0.0	8.4.4	a) Company and Head Office overhead costs.	sum	1		
1.10.0.0	8.4.5	b) General responsibilities and other time related obligations.	sum	1		
1.11.0.0		**OCCUPATIONAL HEALTH & SAFETY (SEE PO)**				
	PSA8.2.4	**Occupational Health & safety** Provision for the cost of the Occupational Health & Safety Act, 85 of 1993, and the relevant regulations:				
		a) Preparation of Health & Safety Plan	sum	1		
		b) Compilation of a Risk Assessment prior to Construction.	sum	1		
		c) Health & safety induction training of employees	sum	1		
		d) Compilation and keeping up with date the Health & Safety file which shall include all documentation required in terms of the Act.	sum	1		
		e) Implementation of the health and Safety plan over the entire construction period	sum	1		
1.12.0.0	**SANS 1200 A**	**PROVISIONAL SUMS**				
1.12.1.0	8.5.b.1	Independent Soil and HDPE testing as directed by the Engineer / Employer	prov			R 50 000
1.12.2.0	8.5.b.1	Building and structure repairs as ordered by the Engineer	prov			R 120 000
1.12.3.0	8.5.b.1	a) Elecrical works required for automatic logger type water meter installations	prov			R 80 000
1.12.3.1	8.5.b.2	b) Overheads, charges & profit on (a) above (max 10%)	%		R 80 000	
1.12.4.0	8.5.b.1	a) As-built survey of all existing manholes and structures (inlet, outlet & cover levels) by Professional Land Surveyor	prov			R 50 000
1.12.4.1	8.5.b.2	b) Overheads, charges & profit on (a) above (max 10%)	%		R 50 000	
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
	SANS 1200 A					
1.13.0.0	**8.8**	**<u>TEMPORARY WORKS</u>**				
1.13.1.0	8.8.4c)	Excavate by hand in all material to expose existing services as directed by Engineer.	m^3	76		
1.13.2.0	8.8.6	Special water control The Contractor to ensure that no water shall flood any portion of the works by providing necessary earth berms from excavated material or placing excavated material on suitable locations. Typical earth berm height min. 400 mm and width at base 1000 mm.	sum	1		
1.13.3.0	8.8.2.0	Dealing with pedestrians The Contractor must provide barricading to prevent pedestrians from entering the site of works.	sum	1		
1.13.4.0	8.8.2.1	Dealing with traffic (Military Base Roads) Provide road traffic sign for working next to or in roads within the military complex (SAFB). Provide road signs: 2 x TW 40 (1200mm), 2 x TR 17 (900 mm), 2 x TW 16 (1200 mm), 40 x DTG (L), 20 x DTG (R),60 plastic cones (700mm) and 30 yellow strobe warning lights	sum	1		
1.13.5.0	8.8.3	Supply and erect hoarding of 2.4m high IBR Hoarding for the protection of existing structures until completion	sum	1		
1.13.5.1	8.8.2.1	Supply and erect 650mm concrete barriers	no	50		
1.13.5.2	8.8.2.1	Delivery of barriers to and from site	sum	1		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200C	**SECTION 2: SITE CLEARANCE**				
		GENERAL All General rates hereunder shall include the loading, transport, offloading and leveling of dumpsite where material is dumped. All material to be transported to the designated dump site. The preferred haul route shall be indicated by the engineer.				
2.1.0.0		**CLEAR AND GRUB**				
2.1.1.0	PSC 8.2.1	Clear and grub areas between buildings and structures. Predominantly hand operations. (Including all trees of girth up to 1m)	m^2	500		
2.1.2.0	PSC 8.2.2	Clean channels from rubble, silt and organic material and trim short all grass and weeds 2m either side of channel.	m	100		
2.1.3.0	PSC 8.2.3	Clean rubble and debris from Stormwater grid inlets and cathpits.	no	2		
2.2.0.0	**8.2.2**	**REMOVE AND GRUB LARGE TREES OF GIRTH:**				
2.2.1.0	8.2.2(a)	Over 1,0 m and up to 2,0 m	no	15		
2.2.2.0	8.2.2(b)	Over 2,0 m and up to 3,0 m	no	8		
2.3.0.0	**8.2.7**	**DISMANTLE and REMOVE PIPELINES, ELECTRICITY AND TRANSMISSION LINES, CABLES, ECT.**				
2.3.1.0	8.2.7	Cut. dismantle and remove 20mm - 100mm cast iron pipe	m	100		
2.3.2.0	8.2.7	Cut. dismantle and remove 50mm - 110mm PVC pipe	m	100		
2.5.1.0	**8.2.8**	**DEMOLISHING OF AND REMOVE STRUCTURES / BUILDING AND DISMANTLE STEEL WORK** All material from demolishing to be transported to dump sites outside the base area identified by the Contractor. Demolish the following:				
2.5.1.1	8.2.8	~~a) Rip up and remove kerbs (up to 350mm high and 400mm wide) and concrete edge restraints of similar size~~	~~m~~			
2.5.1.2		b) Rip up and remove water, sewer and stormwater pipes. Excavation and backfilling to be measured under trench excavations. For pipe dimensions:				
2.5.2.1		i) up to 200 mm dia PVC, HDPE & steel water pipes	m	70		
2.5.2.2		ii) up to 200 mm dia vitrified clay pipes	m	50		
~~2.5.2.3~~		~~iii) 400 to 600 mm concrete pipes~~	~~m~~			
~~2.5.2.4~~		~~iv) 800 to 1200 mm concrete pipes~~	~~m~~			
2.5.3.0	8.2.8	c) Reinforced concrete paving or floor and wall of canal sections of thickness:				
2.5.3.1		75 - 150 mm	m^2	100		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
2.5.4.0	8.2.8	d) Walls, floor and roof of manholes, valve chambers and stormwater inlet structures				
2.5.4.1		Brick walls (110mm thick)	m^2	1000		
2.5.4.2		Brick walls (220mm thick)	m^2	1000		
2.5.5.0	8.2.8	e) Existing fire hydrants				
2.5.5.1		Concrete fire hydrant plinths	no	28		
2.5.6.0	8.2.9	Transport debris to specified sites and dump				
2.5.6.1		b) Long overhaul (Attridgeville:15km one way)	$m^3.km$	3500		
2.6.0.0		**GRASS**				
2.6.1.0	PSC 8.2.5	~~Remove grass in blocks and plant on area filled. Temporary stockpile, and water and maintain prior to placing, as well as water after placing.~~	~~m^2~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 DB	**SECTION 3: EARTH WORKS (PIPE TRENCHES)** Note: All unsuitable material from trench excavations to be disposed of in designated spoil area. The extra-over rates for intermediate and hard rock excavation shall include the cost of disposing of such material not suitable for backfill in this dumpsite. See also scope of works C3.2 Part A.				
3.1.0.0	**8.3.1**	**SITE CLEARANCE**				
~~3.1.1.0~~	~~8.3.1.a~~	~~Clear vegetation and trees of girth up to 1.0m~~	~~m~~			
3.1.3.0	PSDB 8.3.1	Remove topsoil to 150 mm depth, stockpile, maintain, replace and compact to 90% MOD.AASTHO	m^2	590		
3.2.0.0	PSDB 8.3.2	1) Remove surfaced areas by square cutting and disposal of for:				
3.2.1.0		a) Asphalt sections on pipe routes by means of cutting with a diamond tip pavement cutter. The rate shall cover all trench excavation routes up to 1,2 m wide:				
3.2.1.1		1) Up to 50 mm thickness	m^2	100		
3.2.1.2		2) From 50 mm up to 100mm in thickness	m^2	10		
3.2.2.0		b) Concrete:				
3.2.2.1		1) Up to 100mm in thickness	m^2	120		
3.2.2.2		2) From 100mm up to 150 mm in thickness	m^2	5		
3.2.2.3		3) From 150mm up to 200 mm in thickness	m^2	5		
3.2.3.0		c) Brick Paving (stockpile for re-use)	m^2	200		
~~**3.3.0.0**~~	~~**8.3.2**~~ ~~8.3.2(a)~~	~~**EXCAVATION FOR ALL PIPES/DUCTS**~~ ~~Excavate in all material for pipe trenches with inclusion of backfilling and compaction to 93% Mod AASHTO density and dispose of surplus material to designated site.~~ ~~Note: Shoring of deep excavations are included in the rates quoted below. Excavation safety is the responsibility of the Contractor.~~				
~~3.3.1.0~~		~~a) 25 - 125 mm diameter for depths~~				
~~3.3.1.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.1.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.1.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.2.0~~		~~b) 126 - 400 mm diameter for depths~~				
~~3.3.2.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.2.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.2.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.2.3~~		~~4) over 3.0 - up to 4.0m~~	~~m~~			
~~3.3.3.0~~		~~c) 450 mm diameter for depths~~				
~~3.3.3.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.3.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.3.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.3.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.3.5~~		~~5) over 4.0 - up to 5.0 m~~	~~m~~			
~~3.3.4.0~~		~~c) 500 mm diameter for depths~~				
~~3.3.4.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.4.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.4.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.4.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~3.3.5.0~~		~~d) 560 mm diameter for depths~~				
~~3.3.5.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.5.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.5.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.5.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.6.0~~		~~e) 600 mm diameter for depths~~				
~~3.3.6.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.6.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.6.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.6.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.7.0~~		~~f) 700 mm diameter for depths~~				
~~3.3.7.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.7.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.7.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.7.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.8.0~~		~~g) 750 mm diameter for depths~~				
~~3.3.8.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.8.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.8.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.8.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.8.5~~		~~5) over 4.0 - up to 5.0 m~~	~~m~~			
~~3.3.9.0~~		~~h) 800 mm diameter for depths~~				
~~3.3.9.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.9.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.9.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.9.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.10.0~~		~~i) 900 mm diameter for depths~~				
~~3.3.10.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.10.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.10.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.10.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.10.5~~		~~5) over 4.0 - up to 5.0 m~~	~~m~~			
~~3.3.11.0~~		~~j) 1000 mm diameter for depths~~				
~~3.3.11.1~~		~~1) 0 - up to 1.0 m~~	~~m~~			
~~3.3.11.2~~		~~2) over 1.0 - up to 2.0 m~~	~~m~~			
~~3.3.11.3~~		~~3) over 2.0 - up to 3.0 m~~	~~m~~			
~~3.3.11.4~~		~~4) over 3.0 - up to 4.0 m~~	~~m~~			
~~3.3.12.0~~		~~Extra over 3.3.1.0 - 3.3.11.0 for:~~				
~~3.3.12.1~~	~~PSDB 8.3.3~~	~~2) hard rock excavation (Also refer to Particular Specification PB for Blasting Operations)~~	~~m^3~~			
3.3.13.0	PSDB 8.3.4	Tunnelling under fence, electric, palisade, pre-cast or brick or to 1.0m measured horizontally under foundations	no	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
3.4.4.0	8.3.2(b)	Extra over trench and manhole or related excavations to allow for work in confined areas such as between buildings and other structures where access is limited to the use of a TLB only and blasting is prohibited. These excavation rates are subject to a written approval by the engineer.				
3.4.4.1	8.3.2(b)	Soft excavation	m^3	60		
3.4.4.2	PSDB 8.3.3	2) Hard rock excavation	m^3	3		
3.4.5.0	8.3.2(b)	Extra over trench and manhole or related excavations to allow for work in confined areas such as between buildings and other structures and in between services where access is limited to the use of a manual labour only and blasting is prohibited. Rates shall also apply to the location of services specifically called for by the engineer. These excavation rates are subject to a written approval by the engineer.				
3.4.5.1	8.3.2(b)	Soft excavation	m^3	50		
3.4.5.2	PSDB 8.3.3	2) Hard rock excavation	m^3	3		
3.4.6.0	8.3.3.4	Overhaul				
3.4.6.1		b) Long overhaul (Attridgeville:15km one way)	m^3.km	250		
3.5.0.0	**8.3.3**	**EXCAVATION ANCILLARIES**				
3.5.1.0	8.3.3.1	Make up deficiency in backfill material (Provisional)				
3.5.1.1		a) From other necessary excavation on site	m^3	30		
3.5.1.2		b) From commercial or off-site source	m^3	60		
3.6.0.0	8.3.2	Excavate and dispose of unsuitable material from trench bottom.	m^3	10		
~~3.7.2.0~~	~~8.3.3.3~~	~~Compaction in road reserve. Compaction to 95% Mod AASHTO density~~	~~m^3~~			
~~**3.8.0.0**~~	~~**8.3.4**~~	~~**PARTICULAR ITEMS**~~				
~~3.8.1.0~~	~~8.3.4.a~~	~~Shore trench opposite structure or service for depth:~~				
~~3.8.1.1~~		~~1) 0 to 1 m~~	~~m~~			
~~3.8.1.2~~		~~2) 1 to 2 m~~	~~m~~			
~~3.8.1.3~~		~~3) 2 to 3 m~~	~~m~~			
~~3.8.2.0~~	~~8.3.4.b)1)~~	~~Provide 10 l/s sludge pump and 150 m of 75 mm diameter flexible hose for temporary sewer diversions.~~	~~day~~			
~~**3.9.0.0**~~	~~**8.3.5**~~	~~**EXISTING SERVICES**~~				
~~3.9.1.0~~	~~8.3.5a)~~	~~Services intersecting trench~~	~~no~~			
~~3.9.2.0~~	~~8.3.5b)~~	~~Services adjoining trench~~	~~m~~			
3.10.0.0	**8.3.6**	**FINISHING**				
3.10.1.0	8.3.6.1	Reinstate surfaces of trenched areas with:				
3.10.1.1	8.3.6.1b)	Asphalt up to 50 mm thick	m^2	2500		
	8.3.6.1b)	Asphalt 50mm up to 100 mm thick	m^2	75		
3.10.1.3	8.3.6.1b)	Concrete: 25 MPa/ 19 mm 100 mm thick, wood floated finish to match existing	m^2	130		
3.10.1.4	8.3.6.1b)	Concrete: 25 MPa/ 19 mm 150 mm thick, wood floated finish to match existing	m^2	15		
3.10.1.5	8.3.6.1b)	Concrete: 25 MPa/ 19 mm 200 mm thick, wood floated finish to match existing	m^2	15		
3.10.1.6	8.3.6.1b)	Brick paving previously removed	m^2	220		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
3.11.0.0	**8.3.7**	**ACCOMMODATION OF TRAFFIC**				
3.11.1.0	8.3.7	Set up and maintain the road deviation signs as supplied under Section 1 Item 1.13.3.0, 1.13.4.0 and 1.13.5.0. Rate to cover setup of each set of signs.	sum	1		
~~3.11.2.0~~	~~8.3.7~~	~~Provide 4 class sets of trench bridges for vehicle access to span trench width of 2m. Bridges must accommodate trucks up to 15tons (wheel base width up to 2.3m)~~	~~sum~~			
TOTAL CARRIED FORWARD TO SUMMARY						

DEPARTMENT OF PUBLIC WORKS - REPUBLIC OF SOUTH AFRICA
DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT
TENDER NUMBER: H21/ 001 AI
SECTION 4: PIPE JACKING

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	PL	**SECTION 4: PIPEJACKING**				
		Refer to Dwg N/2281/W/3/011 for pipejack details				
4.1.0.0	**PL13.1**	**Establishment on site for**				
4.1.1.0	PL13.1.1	Pipe jacking				
4.1.1.1		a) R101 crossing	sum			
4.1.1.2		b) Runway crossing	sum			
4.2.0.0	**PL13.2**	**Access to and from the thrust and reception pits**				
4.2.1.0		a) R101 crossing	sum			
4.2.1.1		b) Runway crossing	sum			
4.3.0.0	**PL13.3**	**Excavating in soft material for**				
4.3.1.0	PL13.3.1	Thrust and reception pits				
4.3.1.1		a) R101 crossing	sum			
4.3.1.2		b) Runway crossing	sum			
4.4.0.0	**PL13.4**	**Extra over item PL13.3 for excavating hard material**	m^3			
		Note that blasting is prohibited				
4.5.0.0	**PL13.5**	**Backfilling the**				
4.5.1.0	PL13.5.1	Thust and reception pits with				
4.5.1.1	PL13.5.1.1	.01) Excavated material				
		a) R101 crossing	m^3			
		b) Runway crossing	m^3			
4.5.1.2	PL13.5.1.2	.02) Imported material				
		a) R101 crossing	m^3			
		b) Runway crossing	m^3			
4.6.0.0	**PL13.6**	**Supply of pipes to be jacked**				
4.6.1.0		i) 900mm type 100D concrete pipes	m			
4.7.0.0	**PL13.7**	**Jacking of pipes through:**				
4.7.1.0	PL13.7.1	Soft material				
4.7.1.1		a) R101 crossing	m^3			
4.7.1.2		b) Runway crossing	m^3			
4.5.2.0	PL13.7.2	Hard material				
4.5.2.1		a) R101 crossing	m^3			
4.5.2.2		b) Runway crossing	m^3			
4.8.0.0	**PL13.8**	**Jointing and inserting pipes**				
4.8.1.0	PL13.8.1	i) 900mm type 100D concrete pipes	m			
4.9.0.0	**PL13.9**	**The grouting of voids for pipe jacking**				
4.9.1.0	PL13.9.1	Unforeseen and exposed during jacking				
4.9.1.1		a) R101 crossing	kg			
		b) Runway crossing	kg			
4.9.2.0	PL13.9.1	Between pipeline and surrounding material after jacking has been completed				
4.9.2.1		a) 900mm type 100D concrete pipes	m			
4.10.0.0	**PL13.10**	**Timbering and shoring left temporarily in the thrust and reception pits and pipe boring pits**				
4.10.1.0		a) R101 crossing	week			
		b) Runway crossing	week			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 LB	**SECTION 5: BEDDING**				
5.1.0.0	8.2.1	Provision of Bedding Material from trench excavation: Provide class B bedding selected from trench excavation and compacted to 93% Mod AASHTO density. (Material PI to be between 12 and 16)				
5.1.1.0	8.2.1(a)	a) selected granular material not exceeding 6mm in dia.	m^3	25		
5.1.2.0	8.2.1(b)	b) selected fill material (compacted in 150mm layers) First 150mm above HDPE pipes to be filled with material not exceeding 6mm in dia and material PI to be between 12 and 16)	m^3	25		
~~5.2.0.0~~	~~8.2.2.3~~	~~Provision of Bedding material from commercial sources:~~ ~~Provide class B bedding imported from commercial sources and compact to 93% Mod AASHTO density. Rates include provision of, off loading, placing and compaction for: (Material PI to be between 12 and 16)~~				
~~5.2.1.0~~		~~a) selected granular material not exceeding 6mm in dia.~~	~~m^3~~			
~~5.2.2.0~~		~~b) selected fill (compaction in 150 mm layers).~~ ~~First 150mm above HDPE pipes to be filled with material not exceeding 6mm in dia and material PI to be between 12 and 16)~~	~~m^3~~			
~~5.3.0.0~~	~~8.2.3~~	~~Provide class A bedding of (1:12) soilcrete cradle to 50% of pipe diameter. Note that soilcrete will be paid according the limitation of excavation width for the particular pipe size as per SANS 1200 DB or the actual trench width whatever is the smaller.~~	~~m^3~~			
~~5.4.0.0~~	~~8.2.3~~	~~Provide class A bedding of (1:8) soilcrete valve chambers.~~	~~m^3~~			
~~5.5.0.0~~	~~8.2.4~~	~~Encasing of water and sewer pipes up to a nominal diameter of 450mm in 15 Mpa/13mm concrete of minimum 150mm thickness.~~	~~m^3~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 L	**SECTION 6: PIPE WORK - WATER**				
6.1.0.0		**PIPES - HDPE**				
6.1.1.0	PSL 8.2.1a)	HDPE pipes: 40 – 63mm dia Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE 100 Class PN 16 approved solid wall pipe in accordance with ISO 4427. All pipes 160mm and smaller shall be placed inside a HDPE pipe sleeve measured elsewhere. (6.1.3.1) Pipes to be supplied in 100m lengths.				
6.1.1.1		a) 40 mm	m			
6.1.1.2		b) 50 mm	m			
6.1.1.3		c) 63 mm	m			
6.1.2.0	PSL 8.2.1b)	HDPE pipes: 110 – 250mm dia Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE 100 Class PN 12.5 approved solid wall pipe in accordance with ISO 4427. All pipes 160mm and smaller shall be placed inside a HDPE pipe sleeve measured elsewhere. (6.1.3.1) Pipes to be supplied in 12m lengths.				
6.1.2.1		c) 110 mm	m			
6.1.2.2		d) 125 mm	m			
6.1.2.3		e) 140 mm	m			
6.1.2.4		f) 180 mm	m			
6.1.2.5		g) 200 mm	m			
6.1.2.6		h) 250 mm	m			
6.1.3.0	PSL 8.2.1c)	Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE 100 Class PN 10 approved solid wall pipe sleeve in accordance with ISO 4427.				
6.1.3.1		a) 110mm	m			
6.1.3.2		b) 200mm	m			
6.1.3.3		c) 250mm	m			
6.1.3.4		d) 280mm	m			
6.1.3.5		e) 355mm	m			
6.1.4.0	PSL 8.2.1d)	Random destructive Testing				
6.1.4.1		Extra over 6.1.1.0 - 6.1.2.0 for destructive testing of pipes (5%)	sum			
6.2.0.0	**PSL 8.2.2**	**FITTINGS - HDPE** Supply, butt-weld join, lay, bed, test and commission the following solid wall moulded HDPE, type PE100 Class PN16 pipe fittings in accordance with ISO 4427. All fittings for piping prepared for butt welding on site to pipes or other fittings or stub and flange welded on in factory or in field. All stub and flanges measured as an extra over.				
6.2.1.0	8.2.2	a) Equal T-piece				
6.2.1.1		50mm	no			
6.2.1.2		200 mm	no			
6.2.1.3		250 mm	no			
6.2.2.0	8.2.2	b) Long Radius 90° Bends (Seamless)				
6.2.2.1		40 mm	no			
6.2.2.2		50 mm	no			
6.2.2.3		180 mm	no			
6.2.2.4		200 mm	no			
6.2.2.5		250 mm	no			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
6.2.3.0	8.2.2	c) Long Radius 45° Bends (seamless)				
6.2.3.1		180 mm	no			
6.2.3.2		250 mm	no			
6.2.4.0	8.2.2	d) Long Radius 11.25° & 22.5° Bends (seamless)				
6.2.4.1		50mm	no			
6.2.4.2		180 mm	no			
6.2.4.3		200 mm	no			
6.2.4.4		250 mm	no			
6.2.5.0	8.2.2	e) Reducing T-Piece				
6.2.5.1		250 x 200 mm	no			
6.2.5.2		250 x 180 mm	no			
6.2.5.3		250 x 160 mm	no			
6.2.5.4		200 x 160 mm	no			
6.2.5.5		180 x 125 mm	no			
6.2.5.6		140 x 90 mm	no			
6.2.5.7		125 x 110 mm	no			
6.2.5.8		125 x 90 mm	no			
6.2.6.0	8.2.2	f) Reducer				
6.2.6.1		250 x 200 mm	no			
6.2.6.2		250 x 180 mm	no			
6.2.6.3		200 x 160 mm	no			
6.2.6.4		180 x 140 mm	no			
6.2.6.5		180 x 125 mm	no			
6.2.6.6		160 x 140 mm	no			
6.2.6.7		160 x 125 mm	no			
6.2.6.8		160 x 90 mm	no			
6.2.6.9		140 x 125 mm	no			
6.2.6.10		125 x 90 mm	no			
6.2.6.11		90 x 50 mm	no			
6.2.6.12		50 x 40 mm	no			
6.2.7.0	8.2.2	g) Cross piece				
6.2.7.1		250 mm	no			
6.2.7.0	8.2.2	Extra over any pipe to supply and weld on, on site, a HDPE puddle flange, a HDPE stub and steel flange drilled to SANS 1123 Table 1600/3. Rate include supply, lay, installation and fixing as well as all bolts and nuts.				
6.2.7.1		a) 200 mm	no			
6.2.7.2		b) 250 mm	no			
6.3.0.0	**8.2.2**	**VJ - FLANGE ADAPTORS**				
6.3.1.0		Fittings coated with epoxy Copon EP2300 and bolts and washers hot dipped galvanised. All flanges are to be drilled to SANS 1123 Table 1600/3.				
6.3.1.1		a) 250mm dia	no			
6.3.1.3		b) 200mm dia	no			
6.3.1.2		c) 170mm dia	no			
6.3.1.4		d) 150mm dia	no			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
6.4.0.0	**8.2.3**	**VALVES (CAST IRON) - CLASS PN 16**				
6.4.1.0		Supply and install complete waterworks type, SANS 664 approved. non-rising spindle, right hand closing, handwheel and ball thrust collar, cast iron, flanged valve of nominal diameter. (Ainsworth or similar drilled to BS 4504 table 16) All valves in and outside coated with epoxy Coupon EP2300. For diameter:				
6.4.1.2		a) 100 mm	no			
6.4.1.3		b) 150 mm	no			
6.4.1.4		c) 200 mm	no			
6.4.1.5		d) 250 mm	no			
6.5.0.0	**8.2.3**	**NON RETURN VALVE - CLASS PN 16**				
		Supply and install complete a wafer type, double door swing				
6.5.1.0		check valve. For diameter:				
6.5.1.1		a) 200mm	no			
6.6.0.0		**BUILDING CONNECTIONS**				
6.6.1.0	PSL 8.2.23	Building Connections up to 63mmØ				
		Supply and install complete as per dwg. **N/2281/W/3/004** - Detail 1 or Detail 2 a building connection next to main line. Rate includes all fittings from main line according to detail but *exclude the concrete valve box* up to 63mmØ:				
6.6.1.1		a) 32mm	no	1		
6.6.1.3		b) 40mm	no	1		
6.6.1.4		c) 50mm	no	1		
6.7.0.0	**8.2.2**	**FIRE HYDRANT**				
		Supply and install complete as per dwg. **N/2281/W/3/007** a fire hydrant (SANS 1128) next to main line. Rate includes all fittings from main line according to detail but exclude the chamber and tee piece from main line:				
6.7.1.0		Type 1	no			
6.7.2.0		Type 2	no			
6.7.3.0		Type 3	no			
6.8.0.0	**PSL 8.2.14**	**MANHOLES - PRE-MANUFACTURED - HDPE**				
6.8.1.0		a) Fire Hydrant Manholes - Dwg. N/2281/W/3/007	-			
6.8.1.1		1) 1000 -1500 mm	no			
6.9.0.0	**8.2.2**	**G.M.S. FITTINGS**				
6.9.1.0		Supply and fit complete, SANS 509 approved hot dipped galvanised to SANS 763, Mild Steel, Class Medium, fittings. All flanges are to be drilled to SANS 1123 Table 1600/3. (FAE = flanged all ends)				
6.9.1.1	8.2.2	Blank Flange				
		a) 200 mm	no			
		b) 250 mm	no			
6.9.1.2	8.2.2	Pipe piece				
		a) 150mm dia, 2500mm long pipe piece, FAE	no			
		b) 200mm dia, 1000mm long pipe piece, FAE	no			
		c) 200mm dia, 600mm long pipe piece, FAE	no			
		d) 150mm dia, 750mm long pipe piece, FAE	no			
		e) 150mm dia, 450mm long pipe piece, FAE	no			
		f) 100mm dia, 2500mm long pipe piece, FAE	no			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~6.9.1.3~~	~~8.2.2~~	~~90° Bends~~				
		~~a) 200mm short radius bend, FAE~~	~~no~~			
		~~b) 150mm short radius bend, FAE~~	~~no~~			
		~~c) 100mm short radius bend, FAE~~	~~no~~			
		~~d) 50mm short radius bend, FAE~~	~~no~~			
		~~e) 30mm short radius bend~~	~~no~~			
		~~f) 25mm short radius bend~~	~~no~~			
~~6.9.1.4~~	~~8.2.2~~	~~Reducers~~				
		~~a) 250 x 200mm dia concentric reducer, FAE~~	~~no~~			
		~~a) 200 x 150mm dia concentric reducer, FAE~~	~~no~~			
		~~a) 50 x 25mm dia concentric reducer, FAE~~	~~no~~			
~~6.9.1.5~~	~~8.2.2~~	~~Equal Tee Piece~~				
		~~a) 200mm, FAE~~	~~no~~			
		~~b) 50mm, FAE~~	~~no~~			
~~6.9.1.6~~	~~8.2.2~~	~~Reducing Tee Piece~~				
		~~a) 250 x 150mm, FAE~~	~~no~~			
		~~b) 200 x 100mm, FAE~~	~~no~~			
		~~b) 150 x 40mm, FAE~~	~~no~~			
		~~b) 80 x 30mm, FAE~~	~~no~~			
~~6.9.1.7~~	~~8.2.2~~	~~100mm dia Twin booster connection with pressure gauge, B.S.P. female treaded at all ends~~	~~no~~			
~~6.9.1.8~~	~~8.2.2~~	~~90° Short radius bend with Storz coupling, B.S.P. male threaded at one end and female threaded at other end~~	~~no~~			
6.9.2.0	8.2.2	Supply and fit complete, GMS wall bracket as per drawing (DWG N2281/W/3/005) for diameter:				
6.9.2.1		a) 32mm	no	9		
6.9.2.2		b) 40mm	no	7		
6.9.2.3		c) 50mm	no	5		
6.9.2.4		d) 63mm	no	4		
6.9.2.5		e) 90mm	no	2		
6.9.2.6		f) 110mm	no	1		
6.9.2.7		g) 125mm	no	1		
6.9.2.8		h) 200mm	no	1		
6.9.3.0		Supply and fit complete, GMS pipe support bracket as per drawing (DWG N2281/W/3/001 & 14) for diameter:				
6.9.3.1		a) 200mm (Node 67,FHB1)	no	1		
6.9.3.2		b) 150mm (Node 12)	no	1		
6.10.0.0	**PSL 8.2.20**	**QUALITY ASSURANCE OF HDPE WELDED JOINTS**				
6.10.1.0		a) Independent quality control testing of HDPE welded joints	Prov. Sum			R 15 000
6.10.2.0		b) Handling costs and charges on (a) above.(max 10%)	%		R 15 000	
6.11.0.0	**8.2.3**	**MANHOLE COVERS**				
6.11.1.0		Manhole covers and frames build into roofs soffit of valve, stormwater and sewer chambers. See drawing Type No. N/2281/W/3/005 for type:				
~~6.11.1.1~~		~~Type 1~~	~~no~~			
~~6.11.1.2~~		~~Type 2~~	~~no~~			
~~6.11.1.3~~		~~Type 3~~	~~no~~			
~~6.11.1.4~~		~~Type 4~~	~~no~~			
6.11.1.5		Type 5	no	2		
6.11.1.6		Type 6 (Cast Iron)	no	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
6.12.0.0	**PSL 8.2.14**	**MANHOLES AND CHAMBERS**				
6.12.1.0		c) Preparatory work for inspection of existing valves and meters				
6.12.1.1		1) Location and opening of manhole covers and pumping of chambers where necessary for Engineer's inspection	no	2		
6.12.1.2		2) Removal of manhole covers, refuse, rubble, soil, sludge and de-water chamber when required	no	2		
6.12.1.3		3) Cleaning of valves/meters adjacent piping and valve chamber for chamber up to 10m2	no	2		
6.12.1.4		4) Cleaning of valves/meters adjacent piping and valve chamber for chamber exceeding 10m² up to 50m²	no	1		
6.13.0.0	**PSL 8.2.15**	**PREPARATION AND IMPLEMENTATION OF PIPELINE SHUT-DOWN**				
6.13.1.0		a) Prepare and submit shut-down plan for approval by the Engineer	no	1		
6.13.2.0		b) Closure operation of valve and opening of hydrant/scour valve for shut-down purposes				
6.13.2.1		1) Valves of diameter 100mm up to 400mm	no	1		
6.13.2.2		2) Valves of diameter over 400mm up to 600mm	no	1		
6.13.2.3		3) Valves larger than 600mm diameter				Rate Only
6.13.3.0		c) Mobilization, execution of the work and removal of plant, labour and materials for the execution of work required at a shut down operation	no	1		
6.13.4.0		d) Shut down operation extending beyond normal working hours due to circumstances beyond the Contractor's control	no	1		
6.13.5.0		e) Standing time cost PRV site for shut-down and/or replacement operations due to delays not attributable to the Contractor	hr	12		
6.13.6.0		f) Cutting of Existing pipe main/s (steel or AC) inclusive of repair and making good of corrosion protection.				
6.13.6.1		1) Diameter up to 200mm	no	5		
6.13.6.2		2) Diameter up to 400mm	no	2		
6.13.6.3		3) Diameter up to 600mm	no	2		
6.13.7.0		g) Supply and apply approved epoxy coating in Squish pack containers				Rate Only
6.14.0.0	**PSL 8.2.16**	**CONNECT ONTO EXISTING PLUMBING**				
		Rate include the cutting, dismantling of existing fittings next to buildings and connection of new GMS pipes and fittings. For existing connections to building of diameter:				
6.14.1.0		15 mm	no	1		
6.14.2.0		20 mm	no	1		
6.14.3.0		25 mm	no	1		
6.14.4.0		30 mm	no	1		
6.14.5.0		40 mm	no	1		
6.14.6.0		50 mm	no	1		
6.15.0.0	**PSL 8.2.17**	**PIPE MARKERS**				
		Pipe markers as per DWG N2281/W/3/014	no	25		
6.16.0.0	**PSL 8.2.18**	**TESTING**				
		Testing of pipeline	sum	1		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~**6.17.0.0**~~	~~**PSL 8.2.19**~~	~~**ELECTRICAL CABLE AND SERVICES DETECTION**~~				
~~6.17.1.0~~		~~a) Detection of services and cables~~	~~Prov. Sum~~			
~~6.17.2.0~~		~~b) Handling costs and charges on (a) above~~	~~%~~			
~~**6.18.0.0**~~	~~**PSL 8.2.21**~~	~~**WATER METER**~~				
~~6.18.1.0~~		~~Supply, install, test and commission the following combination bulk water meter and measuring device:~~				
~~6.18.1.1~~		~~a) 200 mm dia.~~	~~no~~			
~~6.18.1.2~~		~~b) 150 mm dia.~~	~~no~~			
~~**6.19.0.0**~~	~~**PSL 8.2.22**~~	~~**WATER METER STRAINER**~~				
~~6.19.1.0~~		~~Supply, install, test and commision the following Bulk water meter strainer:~~				
~~6.19.1.1~~		~~a) 200 mm dia.~~	~~no~~			
6.20.0.0	**PSL 8.2.11**	**ANCHOR/THRUST BLOCKS AND PEDESTALS**				
6.20.1.0		Concrete Class 25/19 Thrust blocks	m^3	5		
6.21.0.0	**8.2.5**	**PRESSURE REDUCING VALVES**				
6.21.1.0		Pressure reducing valves capable of reducing pressure from 2400 KPa to 650 KPa. Reducer to be fitted with V-port to accommodate near zero flow volumes effectively. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677) for the following diameters:				
6.21.1.1		15 mm	no	1		
6.21.1.2		20 mm	no	1		
6.21.1.3		25 mm	no	7		
6.21.1.4		30 mm	no	3		
6.21.1.5		40 mm	no	1		
6.21.1.6		50 mm	no	1		
6.22.0.0	**PE 10.4**	**GROUTING OF ABANDONED PIPES**				
6.22.1.0		Grouting of abandoned pipes for diameters with soil-cement as specified pumpable mix.				
6.22.1.1		a) 50 mm dia and smaller pipes	m^3	5		
6.22.1.2		b) 60 - 100 mm dia pipes	m^3	15		
6.22.1.3		c) 125 - 150 mm dia pipes	m^3	30		
6.22.1.4		d) 175 - 200 mm dia pipes	m^3	46		
6.22.1.5		e) 250 mm dia and larger pipes	m^3	63		
6.23.0.0	**8.2.5**	**GATE VALVES - BRASS**				
		Supply and install approved brass, Class 16, full way gate valve for diameter:				
6.23.1.1		15 mm	no	1		
6.23.1.2		20 mm	no	1		
6.23.1.3		25 mm	no	1		
6.23.1.4		30 mm	no	1		
6.23.1.5		40 mm	no	1		
~~**6.2.24.0**~~	~~**8.2.3**~~	~~**SCOUR VALVE**~~				
~~6.2.24.1~~		~~a) 200mm ND RSV for scour valve assembly~~	~~no~~			
6.2.25.0	**SABS1200A**	**INTERNAL PLUMBING**				
6.2.25.1	8.5	a) Intetnal pipes and fittings onto existing sanitary ware.	Prov. Sum			R 100 000
6.2.25.2	8.5.b.2	b) Overheads, charges & profit on (a) above (max 10%)	%		R 100 000	
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	~~SANS 1200 LD~~	~~**SECTION 7: PIPE WORK - SEWERS**~~				
~~7.1.0.0~~	~~PSLD 8.2.1~~	~~**PIPES - HDPE**~~				
	~~PSLD 8.2.1a)~~	~~Supply, lay, butt-weld, joint, bed and test complete as per Type PE100, PN10 pipes to SANS ISO 4427/SANS 4427, in the following diameters:~~				
~~7.1.1.0~~		~~110 mm~~	~~m~~			
~~7.1.2.0~~		~~160 mm~~	~~m~~			
~~7.1.3.0~~		~~200 mm~~	~~m~~			
~~7.1.4.0~~		~~250 mm~~	~~m~~			
~~7.1.5.0~~	~~PSLD 8.2.1b)~~	~~Random destructive Testing~~				
~~7.1.5.1~~		~~Extra over 7.1.1.0 - 7.1.4.0 for destructive testing of pipes (5%)~~	~~sum~~			
7.2.0.0	**8.2.1**	**PIPES - PVC** Supply and fix to outer/inner walls in short lengths to toilet outlets. basins etc. Unplasticised Polyvinyl Chloride pipes (SANS 967) with diameter:				
7.2.1.0		110 mm	m	20		
7.2.3.0		50 mm	m	30		
7.3.0.0	**8.2.1**	**PVC FITTINGS** Supply and fix to outer/inner walls to toilet outlets, basins etc. Unplasticised Polyvinyl Chloride fittings with spigot and socket joints and O-ring seals (SANS 967) with diameter:				
7.3.1.0		110 mm bend with inspection eye	no	5		
7.3.2.0		110 mm bend with 50mm vent horn	no	5		
7.3.3.0		110 mm Kimberley socket	no	5		
7.3.4.0		50 mm Kimberley socket	no	5		
7.3.5.0		110 x 50 mm single reducing junction with inspection	no	5		
7.3.6.0		110 mm bend pan piece with enlarged socket	no	5		
7.3.7.0		50 mm aluminum holder bats	no	60		
7.3.8.0		110 mm aluminum holder bats	no	60		
~~7.4.0.0~~	~~PSLD 8.2.3~~	~~**MANHOLES - PRE-MANUFACTURED - HDPE**~~ ~~Construct manhole complete from a single length 1000mm Ø HDPE PE100 SN8 pipe shaft (minimum 8kN/m2 ring stiffness as per ISO 9969) with inclusion of factory fitted benching (separate item scheduled for types of benching). The manhole must be factory fitted with steps in a staggered pattern and spaced at 250 mm centre to centre and flexible water tight rubber socket joints. Cover slab and lid to be specified as per drawing and measured elsewhere. Including all excavations. Foundation to be 200 mm thick 25 MPa/19mm concrete filled to fully support benching, bottom rim and to extend 200 mm beyond bottom rim of manhole and cast at 300mm wide, 200mm thick 25 MPa/19 mm concrete collar at top of manhole to provide a foundation for the cover slab. Refer to drawing N/2281/S/3/001 & 3. For depths:~~	~~-~~			
~~7.4.1.0~~		~~0000 - 1000 mm~~	~~no~~			
~~7.4.2.0~~		~~1000 -1500 mm~~	~~no~~			
~~7.4.3.0~~		~~1500 - 2000 mm~~	~~no~~			
~~7.4.4.0~~		~~2000 - 2500 mm~~	~~no~~			
~~7.4.5.0~~		~~2500 - 3000 mm~~	~~no~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
7.5.0.0	**PSLD 8.2.3**	**RECONSTRUCT EXISTING MANHOLE BENCHING**				
7.5.1.0	PSLD 5.6.7	Rebuild existing manhole benching by breaking out existing pipes, channels, fittings and benching, replace with new pipes, channels, fittings as required / as per specifications to change the flow direction and reconstruct the benching including reconnecting of all connection pipework of HDPE pipes of nominal diameter and configuration as follows:				
7.5.1.1		a) 160mm outlet				
7.5.1.2		1 Inlet	no	1		
7.5.1.3		2 Inlets	no	5		
7.5.1.4		3 Inlets	no	1		
~~7.5.1.5~~		~~b) 200mm outlet~~				
~~7.5.1.6~~		~~1 Inlet~~	~~no~~			
~~7.5.1.7~~		~~2 Inlets~~	~~no~~			
~~7.5.1.8~~		~~3 Inlets~~	~~no~~			
~~7.5.2.0~~		~~Extra over any junction to weld on in factory a 100 mm long pipe of diameter:~~				
~~7.5.2.1~~		~~110 mm~~	~~no~~			
~~7.5.2.2~~		~~160 mm~~	~~no~~			
~~7.5.2.3~~		~~200 mm~~	~~no~~			
~~**7.6.0.0**~~	~~**8.2.3**~~	~~**MANHOLES - PRE-MANUFACTURED - HDPE**~~				
~~7.6.1.0~~		~~Install complete small diameter HDPE PE100 SN8 pipe shaft (minimum 8kN/m² ring stiffness as per ISO 9969) with factory fitted benching as per drawing. Including excavations. Cover slab and lid to be specified as per drawing and measured elsewhere. Refer to drawing N/2281/S/3/001 & 3. For diameter:~~				
~~7.6.1.1~~		~~b) 500 mm and 0.71 to 1.5 m deep~~	~~no~~			
~~7.6.2.0~~		~~Extra over 7.6.0.0~~				
~~7.6.2.1~~		~~Factory welding on of 110 mm long radius HDPE bend~~	~~no~~			
~~7.6.2.2~~		~~Factory welding on of 110 mm diameter Class 6 HDPE pipe 1000 mm long~~	~~no~~			
~~**7.7.0.0**~~	~~**PSLD 8.2.11**~~	~~**CONNECTING TO EXISTING SEWER**~~				
~~7.7.1.0~~		~~a) Break into existing sewer manholes and connection of new sewer~~	~~no~~			
7.8.0.0	**PSLD 8.2.13**	**MAINTAIN SEWER FLOW**				
7.8.1.0		Maintain sewer flow	no	6		
~~**7.9.0.0**~~	~~**PSLD 8.2.16**~~	~~**LASER EQUIPMENT**~~				
		~~a) Provide, operate and maintain laser equipment~~	~~sum~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
7.10.0.0	**PSLD 8.2.14**	**TESTING OF SEWER**				
7.10.1.0		Testing of sewer:				
7.10.1.1		a) Expose sewer, provide all labour, equipment, including expansible plugs and flexible bag stoppers, perform test and reinstate sewer at test position if required	Sum	1		
7.10.1.2		b) Provide suitable CCTV equipment including the camera, open and close manholes, perform CCTV survey, record on video tape and hand a copy of the video tape to Engineer	m	500		
7.11.0.0	**PSLD 8.2.15**	**QUALITY ASSURANCE OF HDPE WELDED JOINTS**				
7.11.1.0		a) Independent quality control testing of HDPE welded joints	Prov. Sum			R 25 000
7.11.2.0		b) Handling costs and charges on (a) above.	%		R 25 000	
7.12.0.0	**8.2.3**	**MANHOLE COVERS**				
7.12.1.0		Concrete manhole covers and frames build into roofs of valve, stormwater and sewer chambers. See drawing Type No. N/2281/S/3/003 for diameter:				
7.12.1.1		900mm	no	1		
7.12.1.2		1050mm	no	1		
7.12.2.0		Sheet metal covers build into roofs of sewer chambers.				
7.12.2.1		a) 4,5mm Sheet Metal	m^2	20		
7.12.2.2		b) Hinges as per drawing N/2281/S/3/008	no	30		
7.13.0.0	~~**PSLD 8.2.17**~~	~~**FAT TRAP**~~				
7.13.1.0		~~Supply and install fat trap unit as specified~~				
7.13.1.1		~~a) 2l/s Fat trap structure complete~~	~~no~~			
7.14.0.0	**PE 10.4**	**GROUTING OF ABANDONED PIPES**				
		Grouting of abandoned pipes for diameters with soil-cement as specified pumpable mix.				
7.14.1.0		a) 100 mm dia and pipes smaller	m^3	24		
7.14.1.1		b) 125 - 200 mm dia pipes	m^3	15		
7.14.1.2		c) 225 - 250 mm dia pipes	m^3	10		
7.15.0.0	**8.2.3**	**HDPE GULLY**				
7.15.1.0		HDPE gulley complete as per Detail	no	1		
7.16.0.0	**8.2.3**	**SANITARY FITTINGS**				
7.16.1.0		Replace complete white vitreous china pedestal water closet (SABS 497).	no	5		
7.16.2.0		Replace complete, with flush valve, vitreous china wall mounted urinal with bottle trap.	no	5		
7.17.0.0	**SABS1200A**	**INTERNAL PLUMBING**				
7.17.1.0	8.5	a) Intetnal pipes and fittings onto existing sanitary ware.	Prov. Sum			R 30 000
7.17.2.0	8.5.b.2	b) Overheads, charges & profit on (a) above (max 10%)	%		R 30 000	
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200	**SECTION 8: PIPE WORK - STORM WATER**				
8.1.0.0	**LE**	**STORMWATER PIPES**				
8.1.1.0	PSLE 8.2.1a)	Supply, handle, lay, weld joints, bed in Class B and test HDPE PE100 SN8 pipes (minimum 8kN/m2 ring stiffness as per ISO 9969) as shown on drawing N2281/SW/1/001-8 for the following diameters:				
8.1.1.1		300 mm	m	47		
8.1.1.2		450 mm	m	20		
~~8.1.1.3~~		~~500 mm~~	~~m~~			
~~8.1.1.4~~		~~560 mm~~	~~m~~			
~~8.1.1.5~~		~~600 mm~~	~~m~~			
~~8.1.1.6~~		~~700 mm~~	~~m~~			
~~8.1.1.7~~		~~750 mm~~	~~m~~			
~~8.1.1.8~~		~~800 mm~~	~~m~~			
~~8.1.1.9~~		~~900 mm~~	~~m~~			
~~8.1.1.10~~		~~1000 mm~~	~~m~~			
8.1.2.0	PSLE	Random destructive Testing				
8.1.2.1	8.2.1b)	Extra over 8.1.1.0 - 8.1.1.9 for destructive testing of pipes (5%)	sum	1		
8.2.0.0		**HDPE STRUCTURES**				
	PSLE 8.2.8	Supply and install Manholes, Catchpits and the like.				
8.2.1.0		HDPE Grid Inlets				
~~8.2.1.1~~	~~PSLE 8.2.8~~	~~d) Type 1: Grid inlet over manhole complete~~	~~No.~~			
~~8.2.1.2~~	~~PSLE 8.2.8~~	~~e) Type 2: Grid inlet next to runways and taxiways~~	~~No.~~			
8.2.1.3	PSLE 8.2.8	f) Type 3: Grid inlet Complete	No.	4		
8.2.1.4	PSLE 8.2.8	g) Type 4: Grid inlet in building courtyards Complete	No.	4		
~~8.2.2.0~~		~~HDPE Kerb inlets~~				
~~8.2.1.1~~	~~PSLE 8.2.8~~	~~h) Salberg type kerb inlet complete~~	~~No.~~			
~~8.2.3.0~~		~~HDPE Manholes~~				
~~8.2.3.1~~	~~PSLE 8.2.8~~	~~i) Manhole cover slab complete~~	~~No.~~			
~~8.2.4.0~~		~~Stilling basins~~				
~~8.2.4.1~~	~~PSLE 8.2.8~~	~~k) Stilling basin type 1 complete~~	~~No.~~			
8.2.5.0		Manholes				
	PSLE 8.2.8	j) Manholes - Pre-manufactured -HDPE Supply, lay, butt-weld, joint and test complete Type HDPE PE100 SN8 pipe (minimum 8kN/m2 ring stiffness as per ISO 9969) manholes, in the following depths:				
8.2.5.1		a) 1000mm diameter manhole shaft				
~~8.2.5.2~~		~~0 - 1001 mm~~	~~no~~			
8.2.5.3		1001 -1500 mm	no	1		
~~8.2.5.4~~		~~1501 - 2000 mm~~	~~no~~			
~~8.2.5.5~~		~~2001 - 2500 mm~~	~~no~~			
~~8.2.5.6~~		~~2501 - 3000 mm~~	~~no~~			
~~8.2.5.7~~		~~3001 - 3500 mm~~	~~no~~			
~~8.2.5.8~~		~~b) 1200mm diameter manhole shaft~~				
~~8.2.5.9~~		~~0 - 1000 mm~~	~~no~~			
~~8.2.5.10~~		~~1001 -1500 mm~~	~~no~~			
~~8.2.5.11~~		~~1501 - 2000 mm~~	~~no~~			
~~8.2.5.12~~		~~2001 - 2500 mm~~	~~no~~			
~~8.2.5.13~~		~~2501 - 3000 mm~~	~~no~~			
~~8.2.5.14~~		~~3001 - 3500 mm~~	~~no~~			
~~8.2.5.15~~		~~3501 - 4000 mm~~	~~no~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~8.2.16~~		~~4001 - 5000 mm~~	~~no~~			
~~8.2.5.17~~		~~c) 1500mm diameter manhole shaft~~				
~~8.2.5.18~~		~~3000 - 3500 mm~~	~~no~~			
~~8.2.5.19~~		~~3501 - 4000 mm~~	~~no~~			
~~**8.3.0.0**~~		~~**WATER/OIL SEPARATORS FOR WASHBAYS**~~				
~~8.3.1.0~~	~~PSLE 8.2.8~~	~~j) Water / oil separator structure complete as per drawing: N2282/SW/3/002.~~	~~no~~			
8.4.0.0	**PSLE 8.2.7**	**FACTORY FITTED BENCHING - HDPE LARGE MANHOLES** Extra over 8.2.5.2 to 8.2.5.19 to factory fit HDPE manholes with connections. channels and benching for site welding on (not rubber socket ends) of HDPE pipes of nominal diameter and configuration as follows:				
8.4.1.0		a) 450mm dia outlet				
~~8.4.1.1~~		~~0 Inlets (start of network)~~	~~No.~~			
8.4.1.2		1 Inlet	No.	1		
~~8.4.1.3~~		~~2 Inlets~~	~~No.~~			
~~8.4.1.4~~		~~3 Inlets~~	~~No.~~			
~~8.4.2.0~~		~~b) 500mm dia outlet~~				
~~8.4.2.1~~		~~0 Inlets (start of network)~~	~~No.~~			
~~8.4.2.2~~		~~1 Inlet~~	~~No.~~			
~~8.4.3.0~~		~~c) 550mm dia outlet~~				
~~8.4.3.1~~		~~0 Inlets (start of network)~~	~~No.~~			
~~8.4.3.2~~		~~1 Inlet~~	~~No.~~			
~~8.4.4.0~~		~~d) 600mm dia outlet~~				
~~8.4.4.1~~		~~0 Inlets (start of network)~~	~~No.~~			
~~8.4.4.2~~		~~1 inlet~~	~~No.~~			
		~~2 Inlets~~	~~No.~~			
~~8.4.5.0~~		~~e) 700mm dia outlet~~				
~~8.4.5.1~~		~~0 Inlets (start of network)~~	~~No.~~			
~~8.4.5.2~~		~~1 Inlet~~	~~No.~~			
~~8.4.5.3~~		~~2 Inlets~~	~~No.~~			
~~8.4.5.4~~		~~3 Inlets~~	~~No.~~			
~~8.4.6.0~~		~~f) 750mm dia outlet~~				
~~8.4.6.1~~		~~1 Inlet~~	~~No.~~			
~~8.4.6.2~~		~~2 inlets~~	~~No.~~			
~~8.4.7.0~~		~~g) 800mm dia outlet~~				
~~8.4.7.1~~		~~1 Inlet~~	~~No.~~			
~~8.4.7.2~~		~~2 Inlets~~	~~No.~~			
~~8.4.7.3~~		~~3 Inlets~~	~~No.~~			
~~8.4.8.0~~		~~h) 900mm dia outlet~~				
~~8.4.8.1~~		~~1 Inlet~~	~~No.~~			
~~8.4.10.0~~		~~i) 1000mm dia outlet~~				
~~8.4.10.1~~		~~3 Inlets~~	~~No.~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
	~~SANS 1200 LE~~					
~~8.5.0.0~~	~~8.2.10~~	~~ACCESSORIES~~				
~~8.5.1.0~~		~~a) Cast iron manhole covers and frames (SANS 558) build into roofs of valve, stormwater and sewer chambers. See drawing no N2281/SW/3/001 for type:~~				
~~8.5.1.1~~		~~900mm~~	~~no~~			
~~8.5.1.2~~		~~1050mm~~	~~no~~			
8.5.2.0		b) Concrete manhole covers and frames build into roofs of valve, stormwater and sewer chambers. See drawing no N2281/SW/3/001 for diameter:				
8.5.2.1		900mm	no	1		
~~8.5.2.2~~		~~1050mm~~	~~no~~			
~~8.5.2.3~~		~~1200mm~~	~~no~~			
~~8.5.3.0~~		~~c) 750mmØ Access shaft 250mm high~~	~~no~~			
~~8.5.4.0~~		~~d) 560mmØ Round cover/adaptor slab~~	~~no~~			
~~8.6.0.0~~	~~8.2.11~~	~~CONNECTION TO EXISTING MANHOLES~~				
~~8.6.1.0~~		~~Cut into existing manhole, remove benching, replace 300 - 600 mm HDPE pipe~~	~~no~~			
~~8.6.2.0~~		~~601 - 900 mm HDPE pipe~~	~~no~~			
~~8.6.3.0~~		~~901 - 1200 mm HDPE pipe~~	~~no~~			
8.7.0.0	**PSLE 8.2.15**	**QUALITY ASSURANCE OF HDPE WELDED JOINTS**				
8.7.1.0		a) Independent quality control testing of HDPE welded joints	Prov. Sum			R 20 000
8.7.2.0		b) Handling costs and charges on (a) above.	%		R 20 000	
~~8.8.0.0~~	~~PSLE 8.2.17~~	~~LASER EQUIPMENT~~				
~~8.8.1.0~~		~~a) Provide, operate and maintain laser equipment~~	~~sum~~			
8.9.0.0	**PSLE 8.2.18**	**TESTING OF STORMWATER**				
8.9.1.0		Testing of stormwater:				
8.9.1.1		a) Expose stormwater, provide all labour, equipment, including expansible plugs and flexible bag stoppers, perform test and reinstate sewer at test position if required.	Sum	1		
8.9.1.2		b) Provide suitable CCTV equipment including the camera, open and close manholes, perform CCTV survey, record on video tape and hand a copy of the video tape to Engineer	m	500		
8.10.0.0	**PE 10.4**	**GROUTING OF ABANDONED PIPES**				
8.10.1.0		Grouting of abandoned pipes for diameters with soil-cement as specified pumpable mix.				
8.10.1.1		a) 650mm x 520mm box culvert	m^3	20		
~~8.10.1.2~~		~~b) 2400mm x 660mm box culvert~~	~~m^3~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 GA	**SECTION 9: KERBINGS AND CHANNELLING**				
9.1.0.0	**SANS1200A**	**CONCRETE COMPLETE WITH FORMWORK**				
9.1.1.0		Cast in-situ storm water open drain				
9.1.1.1	a)	Repair concrete channel 2800mm wide by selected specialist contractor, 300mm deep V-shaped open drain as per drawing no N2281/SW/3/004 for:				
	8.5.b.1	a) Type A (Vehicle traffic loading)	Prov.			R 50 000
	8.5.b.2	b) Handling costs and charges on (a) above.	%		R 50 000	
	PSGA 8.1.4					
9.1.1.2	b)	Supply all materials and construct 1500mm wide, 150 mm deep V-shaped open drain as per drawing no N2281/SW/3/004 (joints measured elsewhere) for:				
		a) Type A (Vehicle traffic loading)	m	20		
		~~b) Type B (No vehicle traffic loading)~~	~~m~~			
	PSGA 8.1.4					
9.1.1.3	c)	Supply all materials and construct 1200mm wide, 150 mm deep V-shaped open drain as per drawing no N2281/SW/3/004 (joints measured elsewhere) for:				
		a) Type A (Vehicle traffic loading)	m	20		
		b) Type B (No vehicle traffic loading)	m	245		
	PSGA 8.1.4					
9.1.1.4	d)	Supply all materials and construct 600mm wide, 100 mm deep V-shaped open drain as per drawing no N2281/SW/3/004 (joints measured elsewhere) for:				
		a) Type A (Vehicle traffic loading)	m	20		
		b) Type B (No vehicle traffic loading)	m	60		
9.2.0.0	**PSGA 8.2.1**	**SERVICE DUCTS IN ROADS**				
9.2.1.0		Cast in-situ service duct with grating over as per drawing no N/2281/SW/3/004	m	18		
9.2.2.0		Cast in-situ service duct with grating over as per drawing no N/2281/SW/3/004, D=400mm	m	50		
	SANS 1200 MK	**CONCRETE KERBINGS**				
9.3.0.0	8.2.1	Stormwater channeling next to buildings as per drawing no N2281/SW/3/001. For canal width of:				
9.3.1.0		a) 300 mm	m	80		
9.3.1.1		~~b) 1000 mm sections~~	~~no~~			
9.3.1.2		c) 90 degree corner unit	no	5		
9.3.1.3		~~d) Gully entrance~~	~~no~~			
9.3.1.4		e) Type 7 figure straight kerbing	m	5		
9.4.0.0	**SANS 1200 MK**	**POLYETHYLENE SHEETING**				
9.4.1.0	8.2.13	Provide, lay and join 300 micron polyethylene sheeting on prepared surface beds for channelling other that the above.	m^2	50		
9.5.0.0	**SANS 1200 DA**	**EXCAVATION FOR STORMWATER DRAIN (CANAL)**				
	8.3.2(a)	Excavate in all material, including trimming for dished concrete stormwater drains and dispose of surplus material to designated commercial dump site. For depths:				
9.5.1.0		0m - 1.0m	m^3	600		
		~~Extra over 9.5.1.0 for:~~				
~~9.5.3.0~~	~~PSDB 8.3.3~~	~~Hard rock excavation~~ ~~Note that blasting is prohibited~~	~~m^3~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 GA	**SECTION 10: CONCRETE**				
10.1.0.0	**8.2**	**FORMWORK**				
10.1.1.0	8.2.3	Smooth in narrow widths (up to 300 mm) for floor slabs. Form work to allow for continuous reinforcement over joint.	m^2	15		
10.1.2.0	8.2.2	Smooth in widths (up to 800 mm) for platforms or stormwater energy dissipating splitters or benchmark platforms.	m^2	15		
10.1.3.0	8.2.2	Smooth - vertical walls of canal 1.0 to 1.5 m deep and at 45 degree angle	m^2	25		
	8.2.2	Smooth - vertical on inside of valve chambers. sleeve chambers and stormwater catchpits	m^2	25		
10.1.4.0	8.2.2	Smooth - horizontal under slabs and soffits in small (up to 1.5 x 1.5 m) valve chambers etc.	m^2	30		
10.1.5.0	8.2.1	Rough - vertical outside walls of valve boxes etc.	m^2	30		
10.1.6.0	8.2.4	Box out 60 to 200 mm circular holes in 200 mm roof slabs	no	5		
10.2.0.0	**8.3.1**	**REINFORCING**				
10.2.3.0	8.3.1	Y - 16 mm in walls and floors	t	0		
10.2.4.0	8.3.1	Y - 12 mm in walls and floors	t	15		
~~10.2.5.0~~	~~8.3.2~~	~~Ref. 888 steel mesh in walls and floors~~	~~m^2~~			
~~**10.3.0.0**~~		~~**BLINDING LAYER**~~				
~~10.3.1.0~~	~~8.4.2~~	~~a) 50 mm 15 MPa/19 mm blinding layer under 2.0 to 3.0m wide canal floors slab~~	~~m^3~~			
~~10.3.2.0~~		~~b) 50 mm 15 MPa/19 mm blinding layer under water valve chambers~~	~~m^3~~			
10.4.0.0	**8.4**	**CONCRETE**				
~~10.4.1.0~~	~~8.4.3~~	~~15 MPa/19 mm concrete placed at base of sinkhole against natural ground formation and soffits. Curing as per Clause 5.4.7(a).~~	~~m^3~~			
~~10.4.2.0~~	~~8.4.3~~	~~30 MPa/19 mm concrete placed in reinforced floor slabs, canal floors or foundations. Curing as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)~~	~~m^3~~			
~~10.4.3.0~~	~~8.4.3~~	~~30 MPa/19 mm concrete placed in partially reinforced floor slabs. Curing as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)~~	~~m^3~~			
10.4.4.0	8.4.3	25 MPa/19 mm concrete placed in reinforced walls, slabs and soffit of manholes, valve boxes, canal etc. Curing of exposed surfaces as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)	m^3	140		
~~10.4.5.0~~	~~8.4.3~~	~~30 MPa/19 mm concrete placed in reinforced vertical or skew (45 degrees) walls of canal. Curing of exposed surfaces as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)~~	~~m^3~~			
10.5.0.0	**8.4.4**	**FINISHES**				
~~10.5.1.0~~	~~8.4.4(b)~~	~~Steel- floated finish on valve chamber walls and slabs~~	~~m^2~~			
10.5.2.0	8.4.4(a)	Wood- floated finish on valve chamber walls and slabs	m^2	25		
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
	SANS 1200 GA					
10.6.0.0	**8.5**	**JOINTS (NEW)**				
10.6.1.0		Expansion joints Type B complete in stormwater canal floor as per drawing N2281/SW/3/006. Rate includes bond breaker, joint former and slip lining of 10 mm steel bars at 400 mm c/c as well as 10mm bitumen impregnated softboard and polyethelene sheeting	m	10		
10.6.2.0	8.5	Construction joint Type A complete in stormwater canal as per drawing N2281/SW/3/006. Rate includes waterstop and allowance for shutter to accommodate water stop and steel continuous over joint.	m	60		
~~10.6.3.0~~	~~8.5~~	~~10 mm Bitumen impregnated soft board in any joint.~~	~~m^2~~			
~~10.6.4.0~~	~~8.5~~	~~Bitumen rubber seal for joint between concrete and asphalt surfaces. Rate including joint forming and sealant.~~	~~m~~			
10.6.5.0	8.5	Expansion Joint Type D as per drawing N2281/W/3/006	m	25		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 GA	**SECTION 11: JOINT SEALANT**				
	8.5	This section deals with the sealing of joints around buildings, paved areas and existing V-drains. Priced items shall allow for the cleaning of joint from all old filler or debris and jetting clean with compressed air. The joint shall be dry (min 4 days without rain after cleaning). cleaned and prepared inclusive of surface preparation as per manufacturer's instructions for the particular application and insertion of bond breaker and compressible joint filler before applying sealant. No claims for re- cleaning shall be allowed. Joint filler width to depth dimensions are to be according to supplier detail.				
11.1.0.0	**8.5**	**JOINTS - LABOUR AND PROFIT** For items11.1.1.0 to 11.1.3.2 the contractor must submit the total cost of labour, plant and profit of joint sealing exclusive of material. Clean joints. prepare surface and apply:				
11.1.1.0		~~a) Two part compound, cold applied high performance, hydrocarbon resistant polyurethane concrete paved joint sealant for:~~				
~~11.1.1.1~~		~~Joints 0 - 12 mm~~	~~m~~			
~~11.1.1.2~~		~~Joints 12 -15 mm~~	~~m~~			
11.1.2.0	8.5	b) Multi component, gun and pouring grade, polysulphide movement joints sealant for:				
11.1.2.1		Joints 0 - 12 mm	m	4500		
11.1.2.2		Joints 12 -15 mm	m	500		
11.1.3.0	8.5	~~c) One part, cold applied, ultra low modulus, self-leveling silicone joint sealant for asphalt and concrete applications for:~~				
~~11.1.3.1~~		~~Joints 0 - 12 mm~~	~~m~~			
~~11.1.3.2~~		~~Joints 12 -15 mm~~	~~m~~			
11.2.0.0	**8.5**	**MATERIAL** The rate for material shall allow for the supply of material on site ready to use:				
~~11.2.1.0~~		~~a) Two part compound, cold applied high performance, hydrocarbon resistant polyurethane concrete paved joint sealant.~~	~~litre~~			
11.2.2.0		b) Multi component, gun and pouring grade, polysulphide movement joints sealant.	litre	690		
~~11.2.3.0~~		~~c) One part, cold applied, ultra low modulus, self-leveling silicone joint sealant for asphalt and concrete applications.~~	~~litre~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
		SCHEDULE 12: ROADWORKS				
12.1.0.0		**SITE CLEARANCE**				
12.1.1.0	8.2.1	Clear & Grub	ha			
12.1.2.0	8.2.2	Remove and Grub Large Trees and Trees Stumps of Girth:				
12.1.2.1		a) Over 1 m and up to and including 2 m	no			
12.1.2.2		b) Over 2 m and up to and including 3 m	no			
12.1.3.0	8.2.7	Dismantle and remove pipelines, electricity transmission lines, cables, etc.	m			
12.1.4.0	8.2.8	Demolish and remove structures:				
12.1.4.1		a) Remove existing asphalt surfacing for the 500mm overlap, including line cutting of edges next to the buildings.	Sum			
12.1.4.2		b) Remove existing asphalt surfacing for speedhump footings, including cutting of edges at existing and new asphalt.	Sum			
12.1.5.0	8.2.9	Transport materials and debris to unspecified sites and dump:	$m^3.km$			
12.2.0.0	**SANS 1200DM**	**EARTHWORKS (ROADS, SUBGRADE)**				
12.2.1.0	8.3.2	Preperation of Site				
12.2.1.1		a) Removal of topsoil to a 150mm depth, stockpiling and maintaining.	m^3			
12.2.1.2	PSDM 1.1	c) Removal of grass as 0.5m x 0.5m sods for reinstating	m^2			
12.2.2.0	8.3.3	Treatment of Roadbed				
12.2.2.1		a) Road-bed preparation and compaction of material 150mm thick				
12.2.2.2		2) Minimum compaction of 93% mod. AASHTO density.	m^3			
12.2.3.0	8.3.4	Cut to fill, Borrow to fill:				
		Cut to Fill:				
12.2.3.1		a) Compaction to 90% mod. AASHTO density	m^3			
12.2.3.2		b) Rockfill, process, and compact	m^3			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~12.2.4.0~~	~~8.3.4~~	~~Borrow to fill~~				
~~12.2.4.1~~		~~a) Compaction to 90% mod. AASHTO density~~	~~m³~~			
~~**12.3.0.0**~~	~~8.3.5~~	~~**SELECTED LAYERS**~~				
~~12.3.1.0~~		~~a) Selected layer, G6 material (In-situ if to specification), 150mm thick and compacted to 93% of modified AASHTO density.~~	~~m³~~			
~~12.3.2.0~~		~~b) Upper Selected layer, imported G6 natural gravel, 150mm thick and compacted to 93% of modified AASHTO density to runway~~	~~m³~~			
~~12.3.3.~~		~~c) Lower Selected layer,G6 material (In-situ if to specification), 150mm thick and compacted to 93% of modified AASHTO density to runway~~	~~m³~~			
~~**12.4.0.0**~~	~~**SANS 1200 ME**~~	~~**SUBBASE**~~				
~~12.4.1.0~~	~~8.3.3~~	~~Construct subbase with material from commercial sources or designated borrow areas~~				
~~12.4.1.1~~		~~a) Construct a 150mm thick C4 Subbase layer (Compacted to 95% mod. AASHTO density)~~	~~m³~~			
~~12.4.2.0~~	~~8.3.5~~	~~Process Subbase material by the following processes to be used in the Subbase layer:~~				
~~12.4.2.1~~		~~d) Stabilizing (Subbase)~~	~~m³~~			
~~12.4.3.0~~	~~8.3.8~~	~~Stabilizing agent~~				
~~12.4.3.1~~		~~a) Portland cement~~	~~t~~			
~~**12.5.0.0**~~	~~**SANS 1200 MF**~~	~~**BASE**~~				
~~12.5.1.0~~	~~8.3.3~~	~~Construct a Base with material from commercial sources or designated borrow areas~~				
~~12.5.1.1~~		~~b) Natural Gravel (G2)~~	~~m³~~			
12.6.0.0	**SANS 1200 MH**	**ASPHALT BASE AND SURFACING**				
12.6.1.0	8.5.1	Prime Coat (MSP 1 or Similar)	m²	4500		
12.6.2.0	8.5.3	Tack coat (Invert bitumen emulsion)	m²	4500		
12.6.3.0	8.5.4	a) Asphalt for road (30mm thick. Continuously graded, aggregate 13.2mm max.)	ton	120		
12.6.3.1	8.5.4	b) Asphalt for road (30mm thick. Continuously graded, aggregate 13.2mm max.) (by Nominated Sub-contractor)	Prov. Sum			R 250 000
12.6.3.2		c) Handling costs and charges on (b) above.	%		R 250 000	
12.6.4.0		d) Asphalt for speed humps (Continuously graded, aggregate 13.2mm max.) Including cutting of asphalt	ton	48		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
12.7.0.0	**SANS 1200 MM**	**ANCILLARY ROADWORKS**				
	8.3	Permanent Road Signs				
12.7.1.0	8.3.1	Sign faces with galvanized background. with Painted Symbols, Characters, Legend, and borders, and with Signboards Constructed from:				
12.7.1.1	8.3.1	a) Aluminium sheet (2.0 mm thick), of area:				
		1) 0 m² - 2 m²	m²	4		
		2) 2 m² - 10 m²	m²			Rate Only
12.7.2.0	8.3.2	Provision and application of Retro-reflective material:				
12.7.2.1		a) Engineering grade retro reflective background, characters, symbols, legend, and borders	m²	4		
12.7.3.0	8.3.3	Sign Supports				
12.7.3.1		Steel tubing galvanized (Protected with 3 layers of enamel paint and undercoat)	No.	4		
12.7.3.2	8.3.4	Excavation and backfilling and concreting for sign supports	m³	3		
12.7.4.0		Road markings				
12.7.4.1	8.4.1	Non-reflectorized paint applied at nominal rate of 0,42 l/m²				
12.7.4.2		a) White lines (broken or unbroken):				
12.7.4.3		1) 150mm wide	km	0.5		
12.7.4.4		2) 200mm wide	km	0.1		
12.7.4.5		3) 300mm wide	km	0.1		
12.7.4.6		c) White characters and symbols	m²	15		
12.7.4.7		d) Yellow characters and symbols	m²	2		
12.7.4.8		e) Traffic island markings	m²	5		
12.7.5.0	8.4.2	Variation in rate of application from that stated for item 8.4.1(a) to 8.4.1 (e)				
12.7.5.1		a) White paint	l	10		
12.7.5.2		b) Yellow paint	l	10		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~**12.8.0.0**~~	~~**SANS 1200 DM**~~	~~**EARTHWORKS (ROADS, SUBGRADE)**~~				
~~12.8.1.0~~	~~8.3.13~~	~~Surface Finishes:~~				
~~12.8.1.1~~		~~a) Top soiling~~	~~m²~~			
~~12.8.1.2~~		~~b) Grassing~~	~~m²~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	PA	**SECTION 13: SINKHOLE REPAIRS** Specific requirement of work: Work to be executed with a 60 ton mobile crane fitted with boom and appropriate cable, clutch and braking system to handle 12 tons of free falling tamper with face not to exceed 1.0 x 1.0m as well as a 12 ton ball type tamper of 900mm diameter face and a 3.0m diameter 12 ton ironing tamper.				
13.1.0.0		**SITE ESTABLISHMENT**				
13.1.1.0	PA13.1	Allow for site establishment of Dynamic compactor and ancillary equipment for sinkhole repair.	sum			
13.1.2.0	PA13.2	Allow for dismmantling and re-erection for movement on site under own power	No.			
13.1.3.0	PA 13.3	Allow for dismantling and re-erection for movement on site per truck	No.			
13.1.4.0	PA 13.4	Allow for movement on the site under own power	km			
13.1.5.0	PA 13.5	Allow for protection to paved surfaces whilst moving on site under own power	m^2			
13.2.0.0		**EXCAVATION**				
13.2.1.0	PC 4.1	Excavate and open up sidewalls of the sinkhole at 60 deg to the horizontal extending 4m wide by 1 m deep from initial excavation outward.	m^3			
13.3.0.0		**CHOKING**				
13.3.1.0	PC 4.2	Choke the throat of the sinkhole with boulders of 500mm and larger (no fines allowed) or with a mass or reinforced concrete slab or a combination of all these.	m^3			
13.4.0.0	**PA 13.7**	**DYNAMIC COMPACTION**				
13.4.1.0		Compaction into base of excavation				
13.4.1.1	PA 13.7	Primary compaction	blow			
13.4.1.2	PA 13.7	Secondary compaction	blow			
13.4.1.3	PA 13.7	Primary compaction (5 - 10 blows per $25m^2$)	blow			
13.4.1.4	PA 13.7	Secondary compaction (5 - 10 blows per $25m^2$)	blow			
13.1.4.5	PA 13.7	Primary compaction (5 -10 blows per $50m^2$)	blow			
13.1.4.6	PA 13.7	Secondary compaction (5 -10 blows per 50m2)	blow			
13.1.4.7	PA 13.7	Primary compaction (10 - 15 blows per $50m^2$)	blow			
13.1.4.8	PA 13.7	Secondary compaction (10 - 15 blows per $50m^2$)	blow			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~13.4.2.0~~	~~PA 13.7~~	~~Compaction after filling of excavation~~				
~~13.4.2.1~~	~~PA 13.7~~	~~Primary compaction~~	~~blow~~			
~~13.4.2.2~~	~~PA 13.7~~	~~Secondary compaction~~	~~blow~~			
~~13.4.3.0~~	~~PA 13.7~~	~~Compaction after Primary and Secondary compaction (measured above)~~				
~~13.4.3.1~~	~~PA 13.7~~	~~Finishing/Ironing compaction~~	~~blow~~			
13.4.3.2	PA 13.9	Rip & Recompaction of upper 500mm to level using impact compaction (25kJ) to 93% Mod AASHTO	m^2	1200		
~~13.4.4.0~~	~~PA 13.7~~	~~Compaction of sinkhole area~~				
~~13.4.4.1~~	~~PA 13.7~~	~~Primary compaction~~	~~blow~~			
~~13.4.4.2~~	~~PA 13.7~~	~~Secondary compaction~~	~~blow~~			
~~13.4.4.3~~	~~PA 13.7~~	~~Finishing/Ironing compaction~~	~~blow~~			
~~**13.5.0.0**~~	~~**PA 13.8**~~	~~**PLATE LOAD TESTING**~~				
~~13.5.1.0~~		~~Plate load testing to 600 kPa~~	~~No.~~			
~~**13.6.0.0**~~		~~**SPECIAL SAFETY REQUIREMENTS**~~				
~~13.6.1.0~~	~~PC 3.1~~	~~Allow for special safety requirements~~	~~Sum~~			
~~13.7.0.0~~		~~**CRACK SURVEY**~~				
~~13.7.1.0~~		~~Inspection by a competent person of all buildings that may be influenced by compaction activities prior and after compaction~~	~~Sum~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 LC	**SECTION 14: ELECTRICAL WORK (DUCTING)**				
14.1.0.0	**PSLC 8.2.5**	**PIPES - HDPE** Supply, lay, butt-weld, joint, bed and prove duct complete as per Type PE100, PN10 pipes to SANS ISO 4427/SANS 4427, in the following diameters:				
4.1.1.0		a) 110 mm (x 2 No. ducts)	m	50		
4.1.1.1		b) 110 mm (x 4 No. ducts)	m	150		
4.1.1.2		c) 110 mm (x 6 No. ducts)	m	550		
14.1.2.0	PSLC 8.2.6	Random destructive Testing				
14.1.2.1		Extra over 14.1.1.0 for destructive testing of pipes (5%)	sum	1		
14.2.0.0	**PSLC 8.2.8**	**MANHOLES - PRE-MANUFACTURED - HDPE** Construct manhole complete from a single length 1000 mm diameter HDPE PE100 SN8 pipe shaft (minimum 8kN/m2 ring stiffness as per ISO 9969) with inclusion of factory fitted 15mm base plate. The manhole must be factory fitted with steps in a staggered pattern and spaced at 250 mm centre to centre and flexible water tight rubber socket joints. Cover slab and lid to be specified as per drawing and measured elsewhere. Including all excavations. Foundation to be 250 mm thick 25 MPa/19mm concrete filled to fully support benching, bottom rim and to extend 300 mm beyond bottom rim of manhole and cast at 300mm wide, 200mm thick 25 MPa/19 mm concrete collar at top of manhole to provide a foundation for the cover slab. For depths:				
14.2.1.0		1000 -1500 mm	no	35		
14.3.0.0	**8.2.3**	**MANHOLE COVERS**				
14.3.1.0		Heavy duty cast iron manhole covers and frames build into roofs of manhole. See drawing Type No. N/2281/E/3/001 for diameter:				
14.3.1.1		1000 - 1500mm	no	35		
14.4.0.0	**PSLC 8.2.7**	**TESTING**				
14.4.1.1		Testing of duct	sum	1		
4.5.0.0	**PSLC 8.2.10**	**QUALITY ASSURANCE OF HDPE WELDED JOINTS**				
4.5.1.1		a) Independent quality control testing of HDPE welded joints	Prov.			R 13 000
4.5.1.1		b) Handling costs and charges on (a) above (max 10%)	%		R 13 000	
4.6.0.0	**PSLC**	**SPECIAL TESTS REQUESTED BY THE ENGINEER**				
4.6.1.1	**8.2.11**	a) Pipeline acceptance control and testing by an independent inspectorate	Prov. Sum			R 10 000
4.6.1.1		b) Handling costs and charges on (a) above (max 10%)	%		R 10 000	
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS	**SECTION 15: PUMP STATION BUILDING**				
15.1.0.0	1200 D	**EARTHWORKS**				
15.1.1.0		Site Preparation				
15.1.1.1	8.3.1.1	Clear and strip site	m²			
15.1.2.0		Remove topsoil				
15.1.2.1	8.3.1.2	Remove topsoil to a nominal depth of 100mm stockpile and maintain	m²			
15.1.3.0		Bulk excavation				
15.1.3.1	8.3.2 a)	Excavate in all materials and use for embankment or backfill or dispose, as ordered				
15.1.3.2		a) For fire water booster pump station	m³			
15.2.0.0		**RESTRICTED EXCAVATION**				
15.2.1.0		Excavate for restricted foundations, footings and pipe trenches in all materials and use as backfill or				
	8.3.3 a)	embankment or dispose				
15.2.1.1		a) For raw water abstraction point in river embankment	m³			
	SANS					
15.3.0.0	1200G	**CONCRETE WORK**				
15.3.1.0		Concrete				
15.3.1.1	8.4.2	Blinding layer in class 15MPa/19mm to a minimum thickness of 50mm underneath structures	m²			
15.3.2.0	8.4.3	Strength concrete - class 35MPa/19mm				
15.3.2.1		i) Fire Water Booster Pumping Station	m³			
15.3.2.2		ii) Pump plinths	m³			
15.3.2.3		iii) Concrete roof	m³			
15.3.3.0	8.4.3	Screed to:				
15.3.3.1		i) All structures (provisional)	m²			
	SANS					
15.4.0.0	1200G	**CONCRETE: Formwork**				
	8.2.2	**Formwork - Smooth:**				
15.4.1.0		a) Vertical plane				
15.4.1.1		i) Pumping Station wall upstand	m²			
15.4.2.0		b) Horisontal plane				
15.4.2.1		i) Pumping Station roof soffit	m²			
15.4.3.0	8.2.5	c) Narrow widths (up to 300mm wide) to:				
15.4.3.1		i) Raw Water Pumping Station	m			
15.4.4.0		Box-out holes for pipes				
15.4.4.1	8.2.6	Box-out holes, rectangular through concrete 200 to 500 mm thick: for pipework supplied and installed by the Mechanical Contractor :				
15.4.4.2		i) 800 x 400mm box-out for 200mm flanged steel pipe	no			
15.4.4.3		ii) 420 x 420mm box-out for150mm flanged steel pipe	no			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
15.5.0.0		**REINFORCEMENT**				
15.5.1.0	8.3.1	Reinforcement, high tensile steel	t			
15.5.2.0	8.3.1	Reinforcement, mild steel	t			
15.5.3.0	8.3.2	High tensile welded mesh - Ref No 295 (Provisional)	m²			
15.6.0.0	8.4.4	**UNFORMED SURFACE FINISH**				
15.6.1.0		a) Wood floated finish	m²			
15.6.2.0		b) Steel floated finish	m²			
15.7.0.0		**GROUTING / CASTING IN OF PIPES AND SPECIALS**				
15.7.1.0	8.7	a) Grouting/casting in of pipe pieces in the following pipe diameters (Refer also PSG2.6.4)				
15.7.1.1		i) 200 dia flanged steel pipe	no			
15.7.1.2		ii) 300 dia flanged steel pipe	no			
	SANS					
15.8.0.0	**1200G**	**GROUTING**				
15.8.1.0	8.7	Grouting of 20mm dowels into 40mm drilled hole	no			
	PF	**BUILDING WORK**				
15.9.0.0	**PF 9.1.1**	**BRICKWORK OF CLAY BRICKS**				
15.9.1.0		Construct brickwork of clay bricks in Class II mortar for thickness:				
15.9.1.1		b) 230 mm				
		i) Face bricks Type FBS external with 6 mm half round ruled joints and type NFP internal, the latter with joints raked for cement plaster	m²			
15.9.1.2	PF 9.1.4.a	Windows 'Winblock' modular precast concrete window surrounds, finished smooth on exposed surfaces, incl. bedding, jointing and pointing 590x590x260mm Type WB66	no			
15.9.1.3		'Winblok Winvent' natural anodised aluminium 4mm clear float glass, factory glazed window insets complete: a) 590x590 Type WV(A) 66F fixed frame window fixed in surround with silicone sealant adhesive	no			
15.9.1.4		b) 590x590 Type WV) 66T top hung window fixed in surround with silicone sealant adhesive in:	no			
15.10.0.0		**DAMP PROOFING AND FINISHING TO FLOORS, WALLS AND WINDOW CILLS**				
15.10.1.0	PF 9.1.4.b	Single layer 375 micron "Gundle Brickgrip" plastic waterproof sheeting under all walls at top of floor level, and underneath window cills:				
15.10.1.1		a) one brick walls and window cills	m			
15.10.2.0		Plaster				
15.10.2.1	PF 9.1.3	Apply one layer cement plaster (12mm thick) on walls for:				
	-	a) Clay Brickwork	m²			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
15.10.3.0	PF 9.1.3	Painting wall finishes				
15.10.3.1		a) One coat universal undercoat, Type 1 to SANS 681	m²			
15.10.3.2		b) Two coats of Plascon Double Velvet (Camel Hair)	m²			
15.10.4.0	PF 9.1.3	Waterproofing				
15.10.4.1		Waterproofing of pumping station roof with "Acrylastic" as supplied by "Gundle coatings" or similar approved	m²			
15.10.5.0	PF 9.1.4.a	Doors and Frames				
15.10.5.1		a) Framed and ledged solid Meranti door, 3 000 mm wide x 3 400 mm high x 40 mm thick complete with standard Meranti frame, 3 lever lockset, chrome plated handles and polyurethane wood protection. Complete with opening for I-beam as indicated.	no			
		b) Standard 815mm x 2032mm maranti door and frame complete.	no			
15.11.0.0	**SANS 1200 A**	**PROVISIONAL SUMS**				
15.11.1.0		Complete equipment supply and installation for the works to be done by a nominated sub-contractor to be appointed after award of the contract.				
15.11.1.1		a) Supply and erect elevated steel water storage tank	prov			
15.11.1.2		b) Overheads, charges & profit on (b) above	%			
15.12.0.0		**MECHANICAL EQUIPMENT FOR PUMPING STATION**				
15.12.1.0	**PSX2**	Mechanical and electrical works required at the booster pump station				
	PSX2.2	Supply, fabricate, deliver to site and install the following pipes and specials. Wall thickness of steel pipe to be 4,5 mm minimum. Flanges to be drilled to SANS 1123 Table 1600/3.				
15.12.1.1		Item no. PS 1	no			
15.12.1.2		Item no. PS 2	no			
15.12.1.3		Item no. PS 3	no			
15.12.1.4		Item no. PS 4	no			
15.12.1.5		Item no. PS 5	no			
15.12.1.6		Item no. PS 6	no			
15.12.1.7		Item no. PS 7	no			
15.12.1.8		Item no. PS 8	no			
15.12.1.9		Item no. PS 9	no			
15.12.1.10		Item no. PS 10	no			
15.12.1.11		Item no. PS 11	no			
15.12.1.12		Item no. PS 12	no			
15.12.1.13		Item no. PS 13	no			
15.12.1.14		Item no. PS 14	no			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~15.12.1.15~~		~~Item no. PS 15~~	~~no~~			
~~15.12.1.16~~		~~Item no. PS 16~~	~~no~~			
~~15.12.1.17~~		~~Item no. PS 17~~	~~no~~			
~~15.12.1.18~~		~~Item no. PS 18~~	~~no~~			
~~15.12.1.19~~		~~Item no. PS 19~~	~~no~~			
~~15.12.1.20~~		~~Item no. PS 20~~	~~no~~			
~~15.12.1.21~~		~~Item no. PS 21~~	~~no~~			
~~15.12.1.22~~		~~Item no. PS 22~~	~~no~~			
~~15.12.1.23~~		~~Item no. PS 23~~	~~no~~			
~~15.12.1.24~~		~~Item no. PS 24~~	~~no~~			
~~15.12.1.25~~		~~Item no. PS 25~~	~~no~~			
~~15.12.1.26~~		~~Item no. PS 26~~	~~no~~			
~~15.12.1.27~~		~~Item no. PS 27~~	~~no~~			
~~15.12.1.28~~		~~Item no. PS 28~~	~~no~~			
~~15.12.1.29~~		~~Item no. PS 29~~	~~no~~			
~~15.12.1.30~~		~~Item no. PS 30~~	~~no~~			
~~15.12.1.31~~		~~Item no. PS 31~~	~~no~~			
~~15.12.1.32~~		~~Item no. PS 32~~	~~no~~			
~~15.12.1.33~~		~~Item no. PS 33~~	~~no~~			
~~15.12.2.0~~		~~**MECHANICAL EQUIPMENT FOR PUMPING STATION**~~				
	~~**PSX1**~~	~~**Pumps**~~				
~~15.12.2.1~~	~~PSX1.3~~	~~Pump complete with motor, baseplate, monitoring devices, etc~~	~~no~~			
	PSX4	**PIPE SUPPORTS**				
15.12.3.0		**Booster Pump Station**				
15.12.3.1		Pipe support type HL1 (dwg N/2281/W/6/003)	no	1		
~~15.12.3.2~~		~~Pipe support type HL2 (dwg N/2281/W/6/003)~~	~~no~~			
~~**15.13.0.0**~~	~~**PSX5**~~	~~**GANTRY HOISTS**~~				
~~15.13.1.0~~		~~Pump Station~~				
~~15.13.1.1~~	~~PSX5.3~~	~~Manually operated crab and hoist~~	~~No~~			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
15.14.0.0		**ELECTRICAL INSTALLATION**				
15.14.1.0		**Miniature Substation**				
15.14.1.1		11000/400V, 315kVA Miniature Substation (Type B), including plinth, 11kV Isolator with fuses, main 400V Circuitbreaker, CTs and Ammeters, Voltmeter and voltage selector switch, bulk kWh meter. feeder Circuitbreakers. Labelling etc.	Item			
15.14.2.0		**Stand-By Generator**				
15.14.2.1		Supply and install a 300kVA, 3-Phase 400V Standby Diesel Generator, complete, with automatic change-over panel and 4Hr fuel tank.	Item			
15.14.3.0		**Motor Control Centre**				
15.14.3.1		Supply, deliver and install MCC complete with foundation/ steel base frame for mounting , including all internal electrical equipment, wiring and connections as per the detailed specification.	Item			
15.14.3.2		Factory acceptance test	Item			
15.14.3.3		Site Acceptance test	Item			
15.14.3.4		On-site commissioning	Item			
15.14.3.5		Schematic Drawings of MCC	Item			
15.14.4.0		**Emergency Stop Stations**				
15.14.4.1		Floor Pedastal with Emergency Stop Switch	ea			
15.14.5.0		**Emergency Stop Stations**				
15.14.5.1		230V, 16A Socket outlet	Ea			
15.14.5.2		Outdoor Bulkheads	Ea			
15.14.5.3		Indoor Bulkheads	Ea			
15.14.5.4		Indoor Flourescent Lights	Ea			
15.14.5.5		Photocell	Ea			
15.14.5.6		Light Switch (1-Lever)	Ea			
15.14.6.0		**Low Voltage Cables (230/400V)**				
15.14.6.1		1.5mm² 2Core	m			
15.14.6.2		35mm² 4Core	m			
15.14.6.3		50mm² 4Core	m			
15.14.6.4		120mm² 4Core	m			
15.14.6.5		150mm² 4Core	m			
15.14.6.6		185mm² 4Core	m			
15.14.6.7		240mm² 4Core	m			
15.14.7.0		**Low Voltage Cables (230/400V) Terminations**				
15.14.7.1		1.5mm² 2Core	ea			
15.14.7.2		35mm² 4Core	ea			
15.14.7.3		50mm² 4Core	ea			
15.14.7.4		120mm² 4Core	ea			
15.14.7.5		150mm² 4Core	ea			
15.14.7.6		185mm² 4Core	ea			
15.14.7.7		240mm² 4Core	ea			
15.14.8.0		**Insulated Copper Earthwire**				
15.14.8.1		2.5mm²	m			
15.14.8.2		70mm²	m			
15.14.8.3		95mm²	m			
15.14.8.4		120mm²	m			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
~~**15.14.9.0**~~		~~**Insulated Copper Earthwire Terminations**~~				
~~15.14.9.1~~		~~2.5mm²~~	~~ea~~			
~~15.14.9.2~~		~~70mm²~~	~~ea~~			
~~15.14.9.3~~		~~95mm²~~	~~ea~~			
~~15.14.9.4~~		~~120mm²~~	~~ea~~			
~~**15.14.10.0**~~		~~**Heavy duty Cable Ladder and Accessories**~~				
~~15.14.10.1~~		~~200mm wide cable ladder~~	~~m~~			
~~15.14.10.2~~		~~100mm wide cable ladder~~	~~m~~			
~~**15.14.11.0**~~		~~**Medium Voltage Cables (11kV)**~~				
~~15.14.11.1~~		~~70mm² 3Core 11kV PILC Cable~~	~~m~~			
~~15.14.11.2~~		~~120mm² 3Core 11kV PILC Cable~~	~~m~~			
~~**15.14.12.0**~~		~~**Medium Voltage Cables (11kV) Terminations**~~				
~~15.14.12.1~~		~~70mm² 3Core 11kV PILC Cable~~	~~ea~~			
~~15.14.12.2~~		~~120mm² 3Core 11kV PILC Cable~~	~~ea~~			
~~**15.14.13.0**~~		~~**Bare Copper Earth Wire**~~				
~~15.14.13.1~~		~~35mm²~~	~~m~~			
~~15.14.13.2~~		~~50mm²~~	~~m~~			
~~15.14.13.3~~		~~70mm²~~	~~m~~			
~~15.14.13.4~~		~~95mm²~~	~~m~~			
~~**15.14.14.0**~~		~~**Bare Copper Earth Wire Terminations**~~				
~~15.14.14.1~~		~~35mm²~~	~~ea~~			
~~15.14.14.2~~		~~50mm²~~	~~ea~~			
~~15.14.14.3~~		~~70mm²~~	~~ea~~			
~~15.14.14.4~~		~~95mm²~~	~~ea~~			
~~**15.14.15.0**~~		~~**Medium Voltage Cables (11kV) Joints**~~				
~~15.14.15.1~~		~~70mm² 3Core 11kV PILC Cable~~	~~ea~~			
~~15.14.15.2~~		~~120mm² 3Core 11kV PILC Cable~~	~~ea~~			
15.14.16.0		**Cable Tray**				
15.14.16.1		a) 300m Wide Floor Mounted GMS Cable Tray	m	8		
TOTAL CARRIED FORWARD TO SUMMARY						**R 0**

SECTION 16: GEOTECHNICAL DRILLING

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	PD	SECTION 16: GEOTECHNICAL DRILLING				
		Refer to the Particular Specification PD: Exploratory Drilling for Engineering Geological Investigation.				
16.1.0.0	PD 9	SITE ESTABLISHMENT				
16.1.1.0	PD 9.1	Site establishment includes all cost to establish the complete drilling rig and personnel on site as well as the removal thereof after completion of a drilling phase.	no			
16.2.0.0	PD 9.2	SETTING UP AND REMOVAL OF RIGS AT EACH BOREHOLE	no			
16.3.0.0	PD 10	ROTARY PERCUSSION DRILLING (165mm DIAMETER) FOR DEPTHS:				
16.3.1.0	PD 10.2.1	0 to 30m	m			
16.3.2.0	PD 10.2.2	30 to 60m	m			
16.3.3.0	PD 10.2.3	60 to 100m	m			
16.4.0.0	PD 10.3	DRILLING AT INCLINATION (1 - 30 DEGREES) Extra over 16.3.0.0	m			
16.5.0.0	PD 10.6	FOAM/DRILLING MUD	liter			
16.6.0.0	PD 11	CASING				
16.6.1.0	PD 11.1	Temporary Steel Casing	m			
16.6.2.0	PD 11.2	Permanent Casing	m			
16.6.3.0	PD 11.3	Permanent (1,5 m) casing for grouting	no			
16.6.4.0	PD 11.4	Concrete grouting surface plug	no			
16.7.0.0	PD 13	BACKFILLING OF BOREHOLE	m			
16.8.0.0	PD 14	STABILISED GROUTING OF BOREHOLE	m			
16.9.0.0	PD 15	SEAL AND MARKING OF BORE HOLES	no			
16.10.0.0		DPSH TESTING	no			
TOTAL CARRIED FORWARD TO SUMMARY						

SECTION 17: SUBSURFACE GROUTING

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
17.0.0.0	**PE**	**SECTION 17: SUBSURFACE GROUTING**				
		This section deals with the grouting of subsurface cavities or abandoned services with a pumpable concrete or cement/sand or cement/soil mixture. Work shall comprise of the pumping of grout mix directly from grout mixer via flexible pipes attached to down-the-hole steelpipes lowered to a depth as indicated by the Engineer into boreholes or existing sub-surface pipe systems. See Particular Specification PE; Subsurface Grouting.				
17.1.0.0	**PE 9.1**	**SITE ESTABLISHMENT**				
17.1.1.0		Site establishment of grout mixer, pump, flexible hoses and pressure metres. Rate shall include the establishing and maintenance of all equipment on site for the duration of grouting operation.	Sum	1		
17.2.0.0	**PE 9.2**	**SETTING UP OF GROUTING EQUIPMENT**				
17.2.1.0		Set up grouting equipment at each borehole or at a position to grout abandoned sewer and water pipes.	no	30		
17.3.0.0	**PE 11**	**STEEL GROUT PIPES**				
17.3.1.0		Insert 50mm screwed seamless steel pipe in borehole or underground pipe	m	50		
~~17.4.0.0~~	**~~PE 10.3~~**	**~~GROUTING~~**				
		~~Supply, deliver, mix and pump continuously grout as specified below. The amount to be pumped per setup shall be determined by Engineer. For grout type:~~				
~~17.4.1.0~~		~~Grout type 1 - 1 to 2 MPa / 70:30 OPC:FA self compacting concrete utilising crusher- and filler sand to suit a slump of 90 mm. Mix to be pumpable.~~	~~m^3~~			
~~17.4.2.0~~		~~Grout type 2 - 20 /1 filler sand: cement with controlled slump to allow free flowing.~~	~~m^3~~			
~~17.4.3.0~~		~~Grout type 3 - 50 kg cement per /1m3 soil with controlled slump to 350 mm on calcrete flow metre. (See PE 10.2)~~	~~m^3~~			
~~17.5.0.0~~		**~~MATERIAL FOR VARIATIONS IN QUANTITIES~~**				
~~17.5.1.0~~		~~Cement: PC 25~~	~~ton~~			
~~17.5.2.0~~		~~Fine filler/plaster sand~~	~~m^3~~			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
18.0.0.0	**SANS 1200 MJ**	**SECTION 18: SEGMENTED PAVING**				
		Paving measured are predominantly around buildings and at entrance roads, with widths varying from 1,0 m to 5,0 m.				
18.1.0.0	8.2.1	Edge restraints formed with last brick on edge on a 150 x 300 mm, 25 MPa surface bed and 150 x 150 mm rectangular concrete restraint on edge. As per detail Drawing Type No. N/2281/SW/3/009	m	70		
18.2.0.0	8.2.1	Triangular edge restraints as per drawing Detail Drawing N/2281/SW/3/009	m	80		
18.3.0.0	8.2.2	Paving construction of 80 mm grey double ZZ, 25 MPa inter-locking paving bricks, complete including 45 mm (uncompacted thickness) bedding sand, approved weed killer, filler sand with grading less than 1.18 mm and PVC sheeting . Bricks laid in stretcher or herring-bone pattern (Base, subbase and earthworks measured elsewhere). See detail drawing N/2281/SW/3/009	m²	200		
18.4.0.0	8.2.2	Paving construction of 50 mm grey standard bond, 25 MPa paving bricks, complete including 20 mm (uncompacted thickness) bedding sand, approved weed killer, filler sand with grading less than 1.18 mm and PVC sheeting . Bricks laid in stretcher or herring-bone pattern (Base, subbase and earthworks measured elsewhere). See detail drawing N/2281/SW/3/009	m²	950		
~~18.5.0.0~~	~~8.2.2~~	~~Replace existing 50 mm paving in sidewalk with inclusion of 150 mm deep surface preparation of rip and compact to 93 % Mod AASHTO density of in situ material.~~	~~m²~~			
18.6.0.0	8.2.3	Cutting of paving bricks to fit edge restrains from paving of thickness:				
18.7.1.0		50 mm	m	15		
~~18.7.2.0~~		~~80 mm~~	~~m~~			
18.8.0.0	SANS1200 DM	Borrow to fill				
18.8.1.1	8.3.5	Provide min G7 (COLTO) imported from commercial sources and compact to 93% Mod AASHTO density. Rates include provision of, off loading, placing and compaction. The works involves restricted working in confined areas such as internal court yards where access is limited to the use of a manual labour only	m³	95		
18.8.2.0	SANS1200 D	Restricted excavations to shape levels in confined areas such as internal court yards where access is limited to the use of a manual labour only and blasting is prohibited. Rates shall also apply to the location of services specifically called for by the engineer.				
18.8.2.1	8.3.3	Soft excavation	m^3	20		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
19.0.0.0	**PF**	**BUILDING WORKS**				
~~**19.1.0.0**~~	~~**PF 9.1.1**~~	~~**BRICKWORK OF CLAY BRICKS**~~				
~~19.1.1.0~~		~~Construct brickwork of clay bricks in Class II mortar for thickness:~~				
~~19.1.1.1~~		~~a) 110 mm~~	~~m²~~			
~~19.1.1.2~~		~~b) 230 mm~~	~~m²~~			
~~19.1.1.3~~		~~c) 345 mm~~	~~m²~~			
~~**19.2.0.0**~~	~~**PF 9.1.2**~~	~~**BRICKWORK OF CONCRETE BRICKS**~~				
~~19.2.1.0~~		~~Construct brickwork of concrete brick in Class II mortar for thickness:~~				
~~19.2.1.1~~		~~a) 140 mm~~	~~m²~~			
~~19.2.1.2~~		~~b) 190 mm~~	~~m²~~			
~~19.2.1.3~~		~~c) 290 mm~~	~~m²~~			
19.3.0.0	**PF 9.1.3**	**CEMENT PLASTER**				
19.3.1.0		Apply one layer cement plaster (12mm thick) on walls for:				
19.3.1.1		a) Clay Brickwork	m²	120		
~~19.3.1.2~~		~~b) Concrete Blockwork~~	~~m²~~			
~~**19.4.0.0**~~		~~**UNFORMED SURFACE FINISH**~~				
~~19.4.1.0~~		~~a) Wood floated finish~~	~~m²~~			
~~19.4.2.0~~		~~b) Steel floated finish~~	~~m²~~			
19.5.0.0	**PF 9.1.3**	**CEMENT PLASTER - TYROLENE FINISH**				
19.5.1.0		Apply one layer cement plaster (5mm thick) on walls for:				
19.5.1.1		a) Clay Brickwork	m²	120		
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
	SANS 1200 DB	**SECTION 20: EARTH WORKS** Note 1: Amendment to clause 5.2.5.1 - All haul within the site boundary (see drawing No C5210/1) shall be free. Note 2: Earthworks measured here would be general earthworks to improve stormwater drainage, rehabilitation of borrow areas and a limited amount of over-excavation and backfilling of potentially dangerous sinkholes and dolines. The engineer shall be called to site before commencing excavation at any sinkhole or doline and will discuss the geological conditions with the contractor in full as to ensure safe working areas are determined.				
20.1.0.0	**8.3.2**	**BULK EXCAVATIONS**				
20.1.1.0	8.3.2(a)	Import material from commercial off-site sources for backfilling of areas where stormwater drainage needs to be improved, sinkholes or dolines or filling of areas of dynamic compaction. Work shall include excavation, selecting, transporting, off loading, placing and compaction for:				
20.1.1.1		a) 150 mm layers compacted to 93% Mod AASHTO density (using small wall behind compactors) within the sinkhole, doline or other areas requiring filling. (max. boulder size 63mm)	m^3			
20.1.1.2		b) 150 mm layers compacted to 93% Mod AASHTO density (using meduim to large compaction equipment) within the sinkhole, doline or other areas requiring filling.	m^3			
		disposal of for:				
20.2.0.0	**8.3.3**	**RESTRICTED EXCAVATIONS**				
20.2.1.0	8.3.3(a)	Excavate and backfilling in all material to open up areas in or around sinkholes or dolines for backfill in imported layers. Excavation walls shall be trimmed to 60 degrees to the horizontal. (Machine to use: minimum of 6 m reach on boom excavator). Rate include backfilling and compaction to 95% Mod AASHTO density.	m^3			
20.2.2.0		Excavation for stormwater canals and other related structures. Excavated material to be levelled, compacted and generally disposed of within 1000 m of point of excavation. Rate include spreading and levelling of material.	m^3			
TOTAL CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
21.0.0.0	**DWK 6**	**SECTION 14: DAYWORKS**				
21.1.0.0	DWK 6.1	Labourers:				
		(a) Unskilled	hr	750		
		(b) Semi-skilled	hr	3000		
		(c) Skilled	hr	4750		
21.2.0.0	DWK 6.2	Foreman	hr			Rate Only
21.3.0.0	DWK 6.3	Tipper trucks:				
		a) Capacity 6m³ (small)	hr	50		
		b) Capacity 10m³ (medium)	hr	76		
21.4.0.0	DWK 6.4	Loader (0.5 m³ bucket)	hr			Rate Only
21.5.0.0	DWK 6.5	Excavator (CAT 350 or similar)	hr	60		
21.6.0.0	DWK 6.6	Grader (CAT 140G or similar)	hr			Rate Only
21.7.0.0	DWK 6.7	Vibratory roller	hr			Rate Only
21.8.0.0	DWK 6.8	Grid Roller	hr			Rate Only
21.9.0.0	DWK 6.9	Pedestrian roller (Bomag BW 90 or similar)	hr	50		
21.10.0.0	DWK 6.10	Compactors				
		a) Wacker	hr	180		
		b) Plate compactor	hr	100		
21.11.0.0	DWK 6.11	Loader (CAT 416D or similar)	hr	250		
21.12.0.0	DWK 6.12	Watertruck				
		a) Capacity 6,000 litres (small)	hr	100		
		b) Capacity 9,000 litres (medium)	hr			Rate Only
		c) Capacity 15,000 litres (large)	hr			Rate Only
21.13.0.0	DWK 6.13	Dozer (D6 or similar)	hr			Rate Only
21.14.0.0	DWK 6.14	Flatbed truck				
		a) Capacity 3 ton (small)	km	45		
		b) Capacity 5 ton (medium)	km	60		
21.15.0.0	DWK 6.15	LDV (1800 cc minimum)	km	70		
21.16.0.0	DWK 6.16	Walk Behind - Saw	hr	25		
21.17.0.0	DWK 6.17	Compressors (Potable Diesiel Compressor)				
21.17.0.1		a) Small	hr			Rate Only
21.17.0.2		b) Medium	hr	100		
21.17.0.3		c) Large	hr			Rate Only
21.18.0.0	DWK 6.18	Breaker				
21.18.0.1		Air Breaker	hr	100		
21.19.0.0	DWK 6.19	Portable water pumps				
21.19.0.1		a) Small	hr	30		
		b) Medium	hr			Rate Only
TOTAL CARRIED FORWARD						

DEPARTMENT OF PUBLIC WORKS - REPUBLIC OF SOUTH AFRICA
DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT
TENDER NUMBER: H21/ 001 AI
SECTION 21: DAYWORKS

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANT	RATE	TOTAL
BROUGHT FORWARD						
21.20.0.0	DWK 6.20	Materials under dayworks:				
21.20.0.1		a. Materials acquired under dayworks materials	PC Sum			R 1 060 000.00
21.20.0.2		b. Handling cost and profit in respect of Item DWK 6.16 (a) (max 10%)	%		R 1 060 000.00	
TOTAL CARRIED FORWARD TO SUMMARY						

DEPARTMENT OF PUBLIC WORKS - REPUBLIC OF SOUTH AFRICA
DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT
TENDER NUMBER: H21/ 001 AI

SUMMARY OF SCHEDULE OF QUANTITIES

SECTION	DESCRIPTION	TOTAL
SECTION 1:	PRELIMINARY AND GENERAL	
SECTION 2:	SITE CLEARANCE	
SECTION 3:	EARTH WORKS (PIPE TRENCHES)	
SECTION 4:	PIPE JACKING	
SECTION 5:	BEDDING	
SECTION 6:	PIPE WORK - WATER	
SECTION 7:	PIPE WORK - SEWERS	
SECTION 8:	PIPE WORK - STORM WATER	
SECTION 9:	KERBINGS AND CHANNELLING	
SECTION 10:	CONCRETE	
SECTION 11:	JOINT SEALANT	
SECTION 12:	ROADS	
SECTION 13:	SINKHOLE REPAIRS	
SECTION 14:	ELECTRICAL WORK (DUCTING)	
SECTION 15:	PUMP STATION	
SECTION 16:	GEOTECHNICAL DRILLING	
SECTION 17:	SUBSURFACE GROUTING	
SECTION 18:	SEGMENTED PAVING	
SECTION 19:	BOUNDARY WALL	
SECTION 20:	EARTHWORKS	
SECTION 21:	DAYWORKS	
	TOTAL SECTIONS 1 to 21 (EXCL. VAT) :	
	PLUS: VAT @ 15% :	
	CONTRACT AMOUNT: CARRIED TO TENDER FORM (INCL. VAT) :	

Amount in words: _____

Tendered on behalf of: _____

Address: _____

Code & Tel. No: _____

_____ _____

SIGNATURE **DATE**

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPELTION CONTRACT

TECHNICAL DATA SHEETS

1. LININGS AND COATINGS

Item	Description	Unit	Proposal
1.	**Brand and Type**		
1.1	Epoxy	-	.....
1.2	Resin	-	.....
2.	**Mixing and Thinning Instructions**	-	.....
		-	.....
		-	.....
		-	.....
3.	**Solvent Required for Thinning during Application**		
3.1	Recommended Type	-	.....
3.2	Recommended Quantity	ℓ/batch	.....
4.	**Mixed Product**		
4.1	Pot Life	h	.....
5.	**Maximum Recommended Dry Film Thickness**		
5.1	Per Coat	µm	.....
5.2	Number of Coats	No	.....
5.3	Time Intervals between Coats	h	.....
6.	**Recommended Minimum & Maximum Conditions During Application**		
6.1	(a) Pipe surface temperature	Min ºC	.....
6.2	(b) Pipe surface temperature	Max ºC	.....
6.3	(c) Ambient temperature	Min ºC	.....
6.4	(d) Ambient temperature	Max ºC	.....
6.5	(e) Relative Humidity	Min ºC	.....
6.6	(f) Relative Humidity	Max ºC	.....
7.	**Time for Complete Drying and Curing of Steel Surface**	h	.....
8.	**Supporting Documentation**		
8.1	Relevant information the supplier wishes to submit		.....

2. BOOSTER PUMPS

	Description	Unit	Tenderer's Proposal
1.	Pump Details		
1.1	Manufacturer		.....
1.2	Country of Manufacture		.....
1.3	Type		.....
1.4	Model		.....
1.5	Suction Internal Diam.	mm	.....
1.6	Delivery Internal Diam.	mm	.....
1.7	Impeller Diam.	mm	.....
1.8	Type of Pump/Motor Coupling	-	.....
1.9	Type of Bearings	-	.....
1.10	Lubrication System (Bearings)	-	.....
1.11	Mass	kg	.....
1.12	Normal Operative Speed (Pump)	rpm	.....
1.13	Critical Speed of Rotating Element	rpm	.....
1.14	Noise Level	dB	.....
1.15	Coupling		.....
1.15.1.16	Type Manufacture		
2	Pump performance Details		
2.1	Performance curves indicating flow rate and efficiency over the whole range of possible pumping heads be provided.		Attached to Covering Letter Yes/No
2.2	At Rated Duty:		
2.2.1	Power demand	kW	.....
2.2.2	NPSH for pump layout as shown	m	.....
2.2.3	Efficiency	%	.....

3. BOOSTER PUMPS : MOTORS

Item	Description	Unit	Main Offer		Alternative Offer	
1	Manufacturer					
2	Place of manufacture					
3	Type					
4	Type of frame					
5	Insulation Class					
6	Compliance with SANS 948		Yes	No	Yes	No
7	Speed of rotation	rpm				
8	Rated output at Site	kW				
9	Full load current	A				
10	Efficiency at:					
10.1	Full load	%				
10.2	1/2 load	%				
11	Power factor at					
11.1	Full load	%				
11.2	1/2 load	%				
12	Operating voltage	V				
13	Starting method					
14	Starting current	A				
15	Starting time for starting with connected load	sec				
16	Number of consecutive starts at its specified load	No				
17	**Temperature detectors in windings**					
17.1	Type					
17.2	Number					
17.3	Position in winding					
18	**Temperature detectors on bearings**					
18.1	Type					
18.2	Number					
19	**Anti condensation heaters**					
19.1	Total wattage	W				
19.2	Voltage	V				
20.	**Physical detail of electrical motors**					
20.1	Mass of motor	Kg				
20.2	Base plate width	mm				
20.3	Base plate length	mm				
20.4	Base plate height	mm				

4. BOOSTER PUMPS : FORM OF GUARANTEE

PUMPSET EFFICIENCY : We, _____ (Tenderer's name)

hereby guarantee that in normal conditions of operation, the overall efficiency of each pumpset tested in the factory will correspond at Duty Point to the values given in the following table, depending on the motors driving the pumps.

Motor Offer	Motor Manufacturer	Motor kW Required	Efficiency	*
Main offer			0,.....	(1)
			0,.....	(2)
			0,.....	(3)
Alternative			0,.....	(1)
			0,.....	(2)
			0,.....	(3)

* (1) Pump only; (2) Motor only; (3) Combined pumpset efficiency

Note :-

A tolerance of 2% of the guaranteed efficiency is allowed before application of penalties, as detailed in the Clause 1.3.5 of the Technical Specification : Pumps, Pipework and Ancillary Equipment

---

PUMP FLOW : We, _____ (Tenderer's name)

hereby guarantee that in normal conditions of operation, the discharge of each pump as defined in the Technical Specification will be not less than …….. m^3/hr operating against the specified Duty Point head for each pump.

Note :-

No tolerance whatever is allowed on the guaranteed flow at Duty Point, as detailed in the Clause 1.3.5 of the Technical Specification : Pumps, Pipework and Ancillary Equipment Penalties may be applied if the guaranteed figure is not achieved.

SIGNATURE (On behalf of TENDERER) .....

NAME OF SIGNATORY (In ink and in capitals) .....

DATE .....

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

NATIONAL DEPARTMENT OF PUBLIC WORKS

DOLOMITE RISK MANAGEMENT STRATEGY: DOD: SAAF: SWARTKOP AIR FORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: COMPLETION CONTRACT

PART C3: SCOPE OF WORK

C3.1: STANDARD SPECIFICATIONS

C3.2: PROJECT SPECIFICATIONS

C3.3: PARTICULAR SPECIFICATIONS

C3.1 STANDARD SPECIFICATIONS

The standard specifications on which this contract is based are the **South African Bureau of Standards Standardized Specifications for Civil Engineering Construction SANS 1200.** *(Note to compiler. "SANS" has been changed to "SANS"; the SANS 1200 specifications are due to be replaced in the foreseeable future by SANS 1200)*

Although not bound in nor issued with this Document, the following Sections of the Standardized Specifications of SANS 1200 shall form part of this Contract:

SANS 1200 A	:	General
SANS 1200 AA	:	General (Small Works)
SANS 1200 AB	:	Engineer's Office
SANS 1200 C	:	Site Clearance
SANS 1200 D	:	Earthworks
SANS 1200 DB	:	Earthworks (Pipe Trenches)
SANS 1200 DM	:	Earthworks (Roads, Sub-grade)
SANS 1200 GA	:	Concrete (Small Works)
SANS 1200 G	:	Concrete (Structural)
SANS 1200 L	:	Medium-pressure pipelines
SANS 1200 LB	:	Bedding (pipes)
SANS 1200 LC	:	Ducting
SANS 1200 LD	:	Sewers
SANS 1200 LE	:	Stormwater
SANS 1200 LK	:	Valves (Medium Pressure)
SANS 1200 MK	:	Kerbing and channelling
SANS 1200 MJ	:	Segmented Paving
SANS 2001 DP2	:	Construction works 9 Part Dp2 (Medium Pressure pipelines)

Note: Not issued with this document, but available at the Contractor's expense from the SA Bureau of Standards, Private Bag X191, PRETORIA, 0001.

In addition to the abovementioned standard specifications, the following specifications also form part of this Contract.

PW 344 Appropriate Development of Infrastructure on Dolomite Manual Department of Public Works. August 2017. In the event that there is a direct contradiction between the aforementioned standard specification document and this document's specifications, the former shall take preference.

SANS 1936	Development of Dolomite Land, Parts 1,2,3 & 4
SANS 14 / ISO 49	Malleable cast iron fittings threaded to ISO 71
SANS 62-1	Steel pipes: Part 1 Pipes suitable for threading and of nominal size not exceeding 150mm
SANS 62-2	Steel pipes: Part 2 Screwed pieces and pipe fittings of nominal size not exceeding 150mm
SANS 191	Cast steel gate valves
SANS 226	Water taps (metallic)
SANS 370	Steel mesh reinforced polyethylene (PE) pipes for water supply

SANS 371	Steel mesh reinforced polyethylene (PE) pipe fittings for water supply
SANS 460	Copper and copper alloy tubing
SANS 533	Black polyethylene pipes for the conveyance of liquids
SANS 664	Cast iron valves for waterworks
SANS 674	Steel-reinforced spirally wound PE drainage and sewer pipes
SANS 776	Copper alloy valves – heavy duty
SANS 966-1	Components of unplasticized polyvinylchloride (uPVC) pressure pipe systems
SANS 1067	Copper-based fittings for copper tubes
SANS 1123	Pipe Flanges
SANS 1128-1	Fire-fighting equipment Part 1: Components of underground and above ground hydrant systems
SANS 1223	Fibre-cement pressure pipes and couplings
SANS 1294	Precast concrete manhole sections and slabs
SANS 1476	Fabricated flanged steel pipework
SANS 1655	Welding of thermoplastics - Welding rods, fillers and solvents
SANS 1671-1	Welding of thermoplastics — Machines and equipment Part 1: Heated tool welding
SANS 1671-2	Welding of thermoplastics — Machines and equipment Part 2: Electrofusion welding
SANS 1671-3	Welding of thermoplastics — Machines and equipment Part 3: Hot gas welding
SANS 1671-4	Welding of thermoplastics - Machines and equipment Part 4: Hog gas extrusion welding
SANS 1748	Glass-fibre-reinforced thermosetting plastic (GRP) pipes
SANS 1808-13	Water supply and distribution system components Part 13: Diaphragm valves
SANS 1808-15	Water supply and distribution system components Part 15: Mechanical backflow prevention devices
SANS 1808-31	Water supply and distribution system components Part 31: Automatic control valves
SANS 1808-32	Water supply and distribution system components Part 32: Float valves (equilibrium type)
SANS 1808-44	Water supply and distribution system components Part 44: Pipe saddles
SANS 1808-45	Water supply and distribution system components Part 45: Pipe repair clamps
SANS 1882	Polymer concrete surface boxes, manhole and inspection covers, gully grating and frames
SANS 10112	The installation of polypropylene and polyvinyl chloride (UPV-C and PVC-M) pipes
SANS 10268-1	Welding of thermoplastics – Welding processes Part 1: Heated tool welding
SANS 10268-2	Welding of thermoplastics – Welding processes Part 2: Electrofusion welding
SANS 10268-3	Welding of thermoplastics - Welding processes Part 3: Hot gas welding
SANS 10268-4	Welding of thermoplastics – Welding processes Part 4: Hot gas extrusion welding
SANS 10268-10	Welding of thermoplastics – Welding processes Part 10: Weld defects
SANS 10269	Welding of thermoplastics – Testing and approval of welders

SANS 10270	Welding of thermoplastics - Approval of welding procedures and welds
SANS 10403	Formatting and compilation of procurement documents
SANS 4427 / ISO 4277	Polyethylene (PE) pipes for water supply specifications
SANS 14236 / ISO 14236	Plastics pipes and fittings Mechanical joint compression fittings for use with polyethylene pressure pipes in water supply systems
SANS 15874	Plastic piping systems for hot and cold water
SANS 21138	Plastics piping systems for non-pressure underground drainage and sewerage
SANS 21138 Part 1	Material specifications and performance criteria for pipes, fittings and system
SANS 21138 Part 2	Pipes and fittings with smooth external surface, Type A
SANS 21138 Part 3	Pipes and fittings with non-smooth external surface, Type B
SANS 50545 EN545	Ductile iron pipe, fittings, accessories and their joints for water pipelines Requirements and test methods
SANS 6269	Welding of thermoplastics - Test methods for welded joints
DVS 2205-1	Welding Geometry

C3.2 PROJECT SPECIFICATIONS

STATUS

The Project Specification, consisting of two parts, forms an integral part of the contract and supplements the Standard Specifications.

Part A contains a general description of the works, the site and the requirements to be met.
Part B contains variations, amendments and additions to the Standardized Specifications and, if applicable, the Particular Specifications.

In the event of any discrepancy between a part or parts of the Standardised of Particular Specifications and the Project Specification, the Project Specification shall take precedence. In the event of a discrepancy between the specifications, (including the Project Specifications) and the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Engineer before the execution of the work under the relevant item.

A: GENERAL

PS 1 GENERAL DESCRIPTION

Pretoria Swartkop Air Force Base: Dolomite Risk Management: Upgrading of Civil Engineering Services and Sinkhole Rehabilitation: Completion Contract:

PS 2 DESCRIPTION OF THE SITE AND ACCESS

The site of works is the **Swartkop Air Force Base (SAFB).**

The contractor should allow for the movement of construction machinery on site without damage to any surfaced areas.

The whole site is generally accessible by LDV.

PS 3 NATURE OF STRATUM ON SITE

The area is located on known dolomitic strata.

These potentially high-risk areas of previous sinkholes and dolines are not marked on a drawing.

The whole area is located on dolomite (dolomite/chert in various degrees of weathering) of the Chuniespoort Group, Transvaal Sequence. Certain areas are overlaid by younger Karoo rocks of variable depth.

Typically, the residual dolomite is covered by transported, colluvial or wind-blown, aeolian sands, which often have a collapse fabric, which has proven in the past to be problematic.

Numerous sinkholes and dolines were recorded in the past and previous drilling operations did show that cavities of different sizes do exist at variable depth.

Any sudden changes in soil profiles or over excavation of cavities (irrespective of size or depth) encountered must be reported to the engineer immediately. The geotechnical report for the site of works

and particularly the strata with reference to possible cavity formation is available at the offices of the client for perusal.

PS 4 DETAILS OF CONTRACT

The project will include the completion of outstanding works not fully completed under the previous contract, and includes the following:

a) Minor construction and/or replacement of water, sewer and storm water pipes and associated structures with SANS ISO 4427 approved HDPE manufacture pipe material;
b) Upgrading of dolomite non-compliant internal building wet services according to specifications.
c) Commissioning of a water booster pump station and pump sets (Materials supplied by others).
d) Stormwater canals and related valves, manholes and inlet structures.
e) Joint sealing of canals and paved areas.
f) Grouting / removing of existing redundant infrastructure.
g) Rehabilitation of sinkholes (Final earthworks of previously rehabilitated sinkholes);
h) Sections of works to be performed through Dayworks.

** Reference is also made to the detailed list of snag list items and outstanding works attached to this document in Section 4.

PS 5 CONSTRUCTION PROGRAMME

The submission of a construction programme as stated per Clause 5.6 of the General Conditions of Contract (GCC 2010 Edition 2) is compulsory.

Before any work is to be commenced on the site (within a period as stated in Clause 5.6 of the GCC 2010), the Contractor must submit a detailed project programme for the construction of the Works to the Engineer for his acceptance.

In preparation of the construction programme the Contractor must liaise with the Engineer and the programme must take into account the coordination of all activities. The programme must consist of a detailed schedule or block diagram covering all aspects of the Works and the planned time thereof must, with the Contract Period as time basis, be shown.

Rainfall conditions will be taken as abnormal when the average rainfall, as shown in Clause PS 12, is exceeded and the contractor must then apply in writing for extension of the contract period using Clause 5.12 and Clause 10 of the GCC 2010.

The Contractor shall submit to the Engineer a realistic, detailed programme not later than **14 days** after receipt of the Letter of Acceptance. The programme shall be in bar-chart format showing in detail how the Contractor proposes to complete the work covered by this contract by the Due Completion Date.

The following details must be stated:

i. The quantity of work applicable to each bar item as well as the rate at which the work will be completed.
ii. A cash flow projection for the entire project duration.
ii. A budget of the value of completed work, month by month, for the full contract period.
iii. The Contractor's plant commitment on the contract for every fortnight.
iv. The critical path.

The programme shall be kept up to date. If a Contractor fails to maintain progress in terms of the programme, he shall produce a revised programme showing the modifications to the original programme necessary to ensure completion of the Works before the Due Completion Date.

The acceptance of any programme by the Engineer shall have no contractual significance, other than satisfying the Engineer that the Work is carried out according to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. The Engineer will have the right to instruct the Contractor to revise the programme if necessitated by circumstances.

The Contractor must take note of the fact that there will be **three separate weeks** per year during which the Contractor will not be allowed do any work on site due to air shows and other air force events. The Contractor must allow for this time in his programme and will not be granted any extension of time as a result of these periods per year without work (i.e. the Time for Completion will remain **9 months**). The Contractor will be informed of such an event one month in advance.

The Contractor must also take note that some of the pipes/channels to be installed will cut off access to some of the hangers and/or fire station. Other pipes/channels are to be installed in areas on the hard stand that are required for the abovementioned events. The Contractor should take note that these areas are limited to the hard stand/hanger areas. Careful coordination is required with the Department of Defence as to the programming of these pipes/channels in order for the Department to accommodate this inconvenience. The Contractor must therefore allow for staged construction as well as fast track construction for these items in order to minimise the problem. No extension of time will be granted due to the Contractor being instructed to construct these pipes/channels during a specific time.

PS 6 SITE FACILITIES AVAILABLE

PS 6.1 Water Supply

A limited supply of water depending on the size of the camp, can be negotiated with the Department of Defence. The Contractor must supply all necessary materials for the water connection and there will be no cost of the water for the Contractor's account. The water connection must however be metered to ensure responsible usage and the Department reserves the right to charge for water usage in the event that it has become known that there is unnecessary over usage of water by the contractor The area available for the Contractor's camp is indicated on the drawings and water is possibly available from the nearest hanger or building connection. The Contractor will be responsible for the negotiation with the Department of Defence,

shut down, water connection, water meter as well as piping to the Contractor's camp (including road crossing).

The availability of water cannot be guaranteed by the Department and in the event of water no longer being freely available, the Contractor must make his own arrangements to acquire it. The rates tendered for the relevant items in the Preliminary and General Section of the schedule shall include all costs for the establishment and maintenance of water supply to the works and the Contractor shall make his own arrangements for the possible conveyance and storage of water if necessary. The Contractor will be held responsible for any wastage of water due to negligence.

PS 6.2 Power Supply

A limited supply of power, depending on the size of the camp, can be negotiated with the Department of Defence. During power failures and shortages, the Contractor must make his own arrangements for the provision of electricity.

Power may be obtained from the nearest hanger or building and again all costs in obtaining a power supply will be for the Contractor's account. The Contractor shall make his own arrangements for distribution of the power to the works. The cost of the power will be for the Contractor's account.

The rates tendered for the relevant items in the Preliminary and General Section of the schedule shall include all costs for the establishment and maintenance of a power supply to the works

PS 7 SITE FACILITIES REQUIRED

PS 7.1 Facilities for the Engineer

A site office for the Engineer is required inclusive of the following infrastructure:

- Desk, Chair, Cupboard;
- Air-conditioner & heater;
- Wi-Fi/Internet Facilities,
- Printer/copier for A3 & A4 black & white and colour prints/copies;
- Meeting room with table and chairs for 12 people.

PS 7.2 Facilities for the Contractor

The following facilities are required on the site for the Contractor in addition to the facilities required by the Contractor for his own purposes:

- Ablution and Sanitary Facilities:

  The Contractor shall erect and maintain on the site proper ablution facilities. The Contractor shall service and maintain the facilities in a clean and hygienic state for the duration of the contract period and on completion of the works it from the site.

- Site Establishment

The location for the site offices will be confirmed on the site handover meeting.

PS 7.3 Laboratory Facilities (Clause 7 SANS 1200A)

The contractor shall provide Laboratory facilities at an SANAS accredited laboratory to conduct tests as required or as specified/measured in the bills of quantity.

PS 7.4 Departmental Name board

2 Official Name Boards, as per section Part C4.2 Site Information: Construction Notice Board, are required for this contract.

PS 7.5 Housing for the Engineer and/or his Representative

No housing is required for the Engineer or his Representative.

PS 7.6 Telephone Facilities

Telephone and internet (Wi-Fi) facilities are needed on the site. The Contractor shall make an allowance of **R1000-00/m** for the engineer's cell phone account.

PS 7.7 Rail Facilities

The nearest rail siding is Centurion (Sports park).

PS 8 FEATURES REQUIRING SPECIAL ATTENTION

The execution of this contract is primarily the repair and upgrading of Wet Services with particular reference to water, sewer and storm water services. Construction work is to be conducted in areas of highly unstable sub-surface conditions and the Tenderer shall provide **special insurance** to cover the works, machinery and his and the Employer's personnel in the event of ground movement during execution of work.

The Engineer or Employer shall not be responsible or liable for any losses or damages incurred by the Contractor irrespective if it is due to the execution of work as per specifications or as directed in writing or verbally by the Employer or Engineer.

PS 9 SECURITY CLEARANCE OF PERSONNEL

Tenderers to note that the Chief of the South African Defence Force (DOD SAAF SAFB) may require that Security Clearance investigations be conducted on any number of the Tenderer's personnel.

If so required, by the Chief of the South African Defence Force, the Tenderer must remove personnel as indicated immediately and ensure that they have no access to the works or documentation or any other information pertaining the site.

The Employer shall not be liable for any cost concerning the removal of personnel or the effect thereof on

the execution of the work.

PS 10 SPECIAL SECURITY RULES

PS 10.1 Working Hours

The official Base working hours is from **7h00** until **17h00**. All activities must be managed and concluded within the normal working hours of the base. All activities outside of the official working hours are considered after hour work. Any after hour work must be restricted to emergencies and must be prearranged and approved.

PS 10.2 Vetting

The Tenderer should note that the entrance to the base is through security gates where the presentations of a valid South African **Identity document** will be required in order to gain access. All personnel from management to the labours must be vetted. Copies of ID Book/Cards must be made available in advance to enable the vetting process to be followed without hampering your operations. The Base Counter Intelligence Officer will assist and manage this process. Each person wanting to gain access to the Airforce Base on a regular basis will be issued with an identity card and he will be required to present it each time when entering and leaving in addition to having it on him at all times.

PS 10.3 Workforce/HR Component

All personnel/contractors/sub-contractors etc employed for the contract and or providing any form of support may only be South African citizens. **No foreigners will be allowed to gain access to the Base**. The only exception will be for highly skilled persons such as engineers. In this case the required motivations and supporting documents must be submitted at least 6 weeks prior to the required access data for approval and vetting. Strong and decisive action will be taken if this requirement/s is not adhered to and/or met.

PS 10.4 Protective Clothing

All the Contractor‘s personnel will be required to wear a similar brightly coloured uniform (the colour to be agreed upon). The company logo may appear on the uniform as it is only a requirement for identification purposes. This not only helps to identify the personnel but also assist with road and aviation safety.

PS 10.5 Occupational Health and Safety

All Occupational Health and Safety Regulations must be adhered to. All contractors and sub-contractors will be required to agree and sign an undertaking with regards to this before access will be granted to the Base. Non-compliance to OHS regulations will result in immediate suspension of all activities of a non-compliant contractor until compliance is secured.

PS 10.6 Restricted Areas

Please note that access is restricted in the areas as indicated on the drawings and no personnel will be allowed in these areas without prior arrangement. Access to the security area/s must be restricted to the **minimum amount of personnel required** to complete task/s. Labour intensive activity options should not be considered for security areas. Large amounts of employees in the security areas create a Security Risk and possess an Aviation Safety Risk.

PS 10.7 Equipment

Equipment used must be marked and identifiable to prevent disputes whether the equipment belongs to the contractor/visitor or not. All equipment entering the Base **must be declared**. The onus of proof lies with the contractor/visitor to proof ownership and not with the security/base personnel. **Equipment/material will be confiscated where any form of uncertainty exists on ownership.**

PS 10.8 Work Programme

The work programme on where activities will be taking place must be communicated to all relevant parties to ensure support and safety.

PS 10.9 Base Operational Activities

Base Operational activities may not be hampered or stopped by contracted activities. Therefore, the communication and coordination of the Work Programme is crucial to coordinate Base Operational Activities and Contractor Activities.

PS 10.10 Work Yard

A work yard requirement must be communicated with the Base. The placement of the yard must be of such that it does not interfere with Base activities, and its location and operation may not impact negatively on the image of the Base. The yard must be secured by the contractor/s.

PS 10.11 Private Security

The Contractor is responsible for his own site security regardless of his camp being located in a facility guarded by the Department of Defence. The contractor must ensure that all materials, plant and equipment are safely stored. The Contractor is allowed to appoint his own security personnel to keep guard of his camp during all hours, however such personnel may not move beyond the perimeter of the Contractor's camp as the area external to his camp is patrolled by armed personnel appointed by the Department of Defence (DOD). The client or DOD will not be responsible for any loss whatsoever incurred by the Contractor as a result of theft or damage to his property, plant, material or equipment.

PS 10.12 Accommodation

No employees of any company and/or contractor may sleep over on the Base. All employees must vacate the premises after the completion of the day's activities.

PS 10.13 Access Control and Permits

All workers must be signed in and receive access permits for the duration of their deployment at the base. Employees may be required to sign in and out on a daily basis.

PS 10.14 Photographic and IT Equipment

Photographic and IT Equipment is considered **restricted** items and must be declared before access into a security area. The use of these items inside the security area without authorisation **may result in confiscation of the items and prosecution.**

PS 10.15 Prohibited Items

The following Prohibited Items may not enter the base. A Special Authority request may be applicable.

i. Asbestos.
ii. Explosives and incendiary substances and devices.
iii. Blasting caps.
iv. Radioactive materials.
v. Detonators and fuses.
vi. Infectious substances.
vii. Dynamite, gunpowder and plastic explosives.
viii. Magnetised materials
ix. Narcotics (including Cannabis [Dagga/Weed]).

PS 10.16 Restricted Items

The following Restricted Items must be declared before access to the Base. Access may be refused for these items.

i. IT Equipment.
ii. Electronic Storage.
iii. Fireworks and other pyrotechnic devices.
iv. Dangerous Weapons.
v. Fire Arms.
vi. Ammunition
vii. Alcohol
viii. Flammable liquids and solids.
ix. Smoke-generating canisters and cartridges.
x. Gases.
xi. Mines, grenades and other explosive military stores.

PS 10.17 Removal of Old/Demolished/Scrap Material

The removal and/or disposal of any Old/Demolished/Scrap Material with monetary value will not be allowed unless it is contained and specified in the project contractual obligations and scope of work/requirements.

PS 10.18 Aviation Safety

The compliance to all Aviation Safety Rules and Regulations on the Base of the utmost importance. Employees must remain in designated areas and may not wonder off. No vehicles or ground moving equipment will be allowed near the runway/taxiways and/or aircraft apron areas. Transgression/s will be seen in a serious light and may lead to denial of access to the base and/or prosecution.

PS 11 SAFETY

PS 11.1 Safety of Workmen

The safe conduct of the Works shall be a primary consideration and the entire Works shall be carried out in conformity with all applicable statutory regulations and requirements and Tenderers must price their Tenders accordingly. The following legislation shall specifically apply:

1. Occupational Health and Safety (OHS) Act (Act 85 of 1993).
2. General Administrative Regulations R.929 of 25 June 2003 under the OHS Act.
3. General Safety Regulations R.1031 of 30 May 1986 under the OHS Act.
4. Regulations for Hazardous Biological Agents R.1390 of 27 December 2001 under the OHS Act.
5. Explosives Regulations R.109 of 17 January 2003 under the OHS Act.
6. Construction Regulations of 7 February 2014 under the OHS Act.
7. Asbestos Regulations R.155 of 10 February 2002 under the OHS Act.
8. Environmental Regulations for Workplaces R.2281 of 16 October 1987 under the OHS Act.
9. Facilities Regulations R.924 of 3 August 2004 under the OHS Act.
10. Hazardous Chemical Substances Regulations R.1179 of 25 August 1995 under the OHS Act.
11. Lead Regulations R.236 of 28 February 2002 under the OHS Act.
12. Noise-induced Hearing Loss Regulations R.307 of 7 March 2003 under the OHS Act.
13. Driven Machinery Regulations R.295 of 26 February 1988 under the OHS Act.
14. General Machinery Regulations R.1521 of 5 August 1988 under the OHS Act.
15. Pressure Equipment Regulations R.734 of 15 July 2009 under the OHS Act.
16. Electrical Installation Regulations R.242 of 6 March 2009 under the OHS Act.
17. Electrical Machinery Regulations R.250 of 25 March 2011 under the OHS Act.

The Contractor shall provide and maintain in readiness on the Site, all equipment, and materials necessary to render first aid in case of accidents or other emergencies. The Contractor shall also assign to the Works and designate for this purpose, trained employees who are able to render first aid.

PS 11.2 Health and Safety Requirements

It is a requirement of this contract that the Contractor shall provide a safe working environment and to direct all his activities in such a manner that his employees and any other persons who may be directly affected by his activities are not exposed to hazards to their health and safety.

To this end the Contractor shall conform to all the stipulations of the Occupational Health and Safety Act (Act 85 of 1993) and the Regulations applicable at the time of tender, which inter alia provide for the designation of a health and safety representative (or representatives) when an employer has more than 20 employees in his employ.

The following shall govern:

1. The Contractor shall execute the work in accordance with the Contract document pertaining to this contract and shall be the Employer's representative regarding occupational health and safety for all activities on the site but without derogating from his status in his own right as an Employer or user in accordance with the Occupational Health and Safety Act, 1993 (Act no. 85 of 1993).

2. This Agreement shall hold good from the commencement date of the Contract up to completion or termination thereof.

3. The Contractor declares himself to be conversant with the following:

   a) All the requirements, regulations and standards of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), hereinafter referred to as "the Act" together with its regulations and amendments.
   b) The procedures and safety rules of the Employer as pertaining to the Contractor and to all his subcontractors.
   c) The purpose and meaning of this Agreement as envisaged by the provisions of the Section 37(2) of the Act.

4. In addition to the requirements of the Contract documents, the Contractor agrees to execute all the works forming part of this Contract and to operate and utilize all machinery, plant and equipment in accordance with the Act.

5. The Contractor is responsible for the compliance with the Act by all his subcontractors, whether or not nominated and/or approved by the Employer

6. The Contractor hereby accepts sole liability for the compliance with the relevant duties, obligations and prohibitions imposed by the Act and expressly absolve the employer and the employer's consulting engineers from being obliged to comply with any of the aforesaid duties, obligations and prohibitions in respect of the work included in the contract.

7. The Contractor shall be obliged to report forthwith to the employer any investigation, complaint, or criminal charge which may arise as a consequence of the provision of the Act pursuant to work performed on behalf of the employer, and shall, on written demand, provide full details in writing of such investigation, complaint of criminal charge.

PS 12 RAINFALL FIGURES

The following figures are applicable for new **Clause 2.2.5** of the Contract data.

INFORMATION SOURCE: South African Weather Service
Pretoria, Tel.: (+27) 82 233 8484
RAINFALL STATION: Irene:

PERIOD: 2008 – 2018

PRETORIA UNISA		
Month	**Rn**	**Nn**
JANUARY	124,3	12,4
FEBRUARY	96,9	8,5
MARCH	128	7,6
APRIL	47	5,5
MAY	19,4	2,4
JUNE	5,7	1,1
JULY	1,9	0,5
AUGUST	1,9	0,5
SEPTEMBER	18,7	1,8
OCTOBER	63,9	7,1
NOVEMBER	115,1	10,5
DECEMBER	146,1	12
Total	**768,9**	**69,8**

Nn = Average amount of days on which a rainfall of 10 mm or more has been recorded.
Rn = Average monthly rainfall in mm.
The Contractor is responsible to provide a rain measuring gauge on site and submit the rainfall figures on a monthly basis to the Engineer.

PS 13 SUB-CONTRACTORS

The Employer shall have the right to cede any sub-contract under this contract to a pre-approved subcontractor, in accordance with the provisions of **Clause 4.4** of the **GCC 2010**.

PS 14 SUPPLY OF MATERIALS

PS 14.1 Pipes and Other Related Materials

All material to be used in the Works is to be supplied by the Contractor. The tender acceptance shall be subject to the submission (one submission only) and approval of the HDPE product manufacturer/s or supplier/s to be used by the Tenderer. Such submissions may be called for during the evaluation of Tenders. The Client reserves the right to reject a Tender if the proposed manufacturer or supplier of HDPE products does not meet the requirements as stipulated in the relevant specifications.

The Contractor shall ensure that the work is not delayed due to the lack of materials on Site, by placing orders for material required under this Contract as soon as possible. No extension of time will be allowed for any delay due to the supply of materials.

Although the quantities have been carefully calculated, it must be considered as approximate only and the Contractor, before ordering any materials, should check the quantities required on the detailed layout drawings. The bill of quantities is only provisional.

PS 14.2 Supply and Delivery of Pumps and Related Materials

Comprehensive information covering every item of equipment forming part of this tender are indicated on the forms included in Technical Data Sheet Section (yellow pages) found after the Schedule of Quantities. The tender under this contract will only be required to connect all electrical and mechanical for the purposes of commissioning of the booster pump sets and back-up generator.

Equipment (pipework, pumps, etc.) supplied in the previous Contract are housed in the pump station building already constructed. There are minor pipe items to still be cast into concrete walls.

PS 14.3 Installation and Commissioning

The term “Install and Commission” of material and equipment will include the on-site handling, transport, positioning, erection, connection, anchoring, installation and protection thereof, as well as the successful completion of all the specified tests on completion.

Tender rates must provide for all the costs by the Contractor to “Install and Commission”. Payment will be made in accordance with Clause 6.10 of the Special Condition of Contract for the “erection and installation” and “commissioning” items in the Schedule of Quantities. The installation and commissioning of equipment under this Contract will require careful coordination with the other Contractors on Site. The tendered rate for “other time related obligations” found in the Preliminary & General section of the Schedule of Quantities is to include for any costs relating to the coordination with other Contractors.

Each pumpset must be numbered, e.g. water pumpset No 1, No 2, etc. Appropriately sized marker plates with this information, must be fitted to each piece of equipment. The numbering systems and finishing of the plates to be approved by the Engineer. The marker plates will be large enough to be readable from 5 to 10m.

The Taking-Over Certificate will be issued after the successful commissioning of all equipment is completed and the reliability run has been completed successfully. The twelve months defects liability period will start on the date stated in the Taking-Over Certificate. The Surety will be returned to the Contractor after issuing of the Taking-Over Certificate and half of the retention monies will be paid out. After the defect’s liability period has elapsed, the remaining retention monies will be paid out. The Taking-Over Certificate will not be issued until all the documents required in terms of this Contract have been lodged with and accepted as satisfactory by the Engineer.

PS 14.4 Quality Control and Testing

a. Quality Control

An independent quality control authority may be used to inspect pumps, pipes, fittings and valves at the factory as well as to witness tests at the factory. Fourteen days’ notice must be given when items need to be inspected. All tests will be witnessed. An independent laboratory may be used to verify that the media for the filters comply with the specifications.

b. Testing

All pumps shall be tested at the manufacturer's works, or some independent organisation, to confirm that it meets the requirements in accordance with Technical Specification: Pumps, Pipework and Ancillary Equipment. Special reference is made to Clause 1.3.3.5 which states "Each pump complete with its driving unit shall be tested at the Manufacturer's works, or other location approved by the Engineer to "Class B" requirements of BS 5316 Part 2".

The original test certificates must be handed to the Engineer. A separate provisional pay-item is provided for Independent Performance Tests. The Client may require additional performance testing of pump/motor units to be carried out by an independent institution such as the South African Bureau of Standards.

PS 14.5 Servicing

Without limiting the obligations or responsibilities of the Contractor for maintenance in any way, the Contractor shall make regular quarterly visits to the Works during the defects liability period to supervise the maintenance of the equipment supplied. During these visits, he shall make all adjustments and do everything necessary to ensure the proper running of the equipment supplied. After each supervising visit to the Site, the Contractor shall submit to the Engineer a report on:

- the condition of the equipment supplied and the servicing work carried out;
- any adjustments which may have been made;
- any equipment failures which may have occurred; and
- any problems envisaged.

The last servicing visit shall be carried out during the last week of the defects liability period during which visit the Contractor shall carry out a full inspection on the equipment to check that all necessary settings are correct and he shall carry out any adjustments necessary. The defects liability period will not terminate until the Engineer is satisfied that the Contractor has finally checked and adjusted the equipment. The maintenance period of any failed component will be extended by 12 months upon re-commissioning.

PS 14.6 Tools and Spares

As part of the equipment supplied, the Contractor shall supply all special tools or keys required for adjustment to any parts of such equipment. The Contractor shall supply a list of spares recommended to be kept in store on Site by the Employer. Such spares shall only be ordered upon approval by the Engineer.

PS 14.7 Operation Manuals

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

- A general arrangement drawing showing the position of all the monitoring equipment.
- Drawings of the equipment detailing all part numbers and materials.

- A complete recommended spares list.
- A lubrication and maintenance schedule showing all maintenance and lubrication operations, their recommended frequency and the grades of lubricant required.
- A maintenance brochure describing all maintenance, adjustment and replacement procedures.
- Performance curves as determined from the SANS tests where applicable or factory tests.
- All dismantling and reassembly procedures.
- Maintenance procedure for corrosion protection painting systems.
- The Contractor shall amplify and amend such drafts until the Engineer is satisfied that they will fulfil the purpose of ensuring that the Employer's staff is adequately instructed to operate and maintain the works. Once the drafts have been approved by the Engineer, the Contractor shall prepare three suitably bound copies and deliver them to the Engineer.
- The manuals shall be drawn up in English.

PS 15 TIME FOR COMPLETION

The maximum time allowed for the completion of the contract is **6 months** from the date of Letter of Acceptance and include all **Public and Builder's Holidays as well as the three separate weeks per year for air force activities** as specified in the Contract Data.

PS 16 EXECUTION OF WORKS

No portion of the work shall be proceeded with until the Engineer or his representative has examined and approved the previous stage. If any work is covered or hidden from view before the Engineer or his representative has inspected the work, the Contractor shall at his own cost expose the covered or hidden work for inspection. The Contractor shall also be responsible for making good any work damaged during the uncovering.

PS 17 QUALITY OF THE WORKS

PS 17.1 Quality Plan

The Contractor is required to prepare and submit a Quality Control Plan (QCP) of the proposed works to be performed for acceptance by the Engineer. This will include, but not limited to the following:

a. General Engineering Works

It is the contractor's responsibility to institute an appropriate Quality Assurance system on site. All materials i.e. request, quantity, delivery, excavations etc, as well as indicated in Section C3 of the Contract document must be inspected and approved by the Engineers.

b. Special Engineering Works

The special works include all steel and HDPE pipework as scheduled in the Bill of Quantities and referenced to specific specifications.

No work shall be allowed to continue without the above approved QCP documentation being in place. The Contractor is to ensure sufficient allowance has been made in the Preliminary and General costs in order to comply with the necessary requirements for approval.

PS 17.2 Sample Work Approach

A sample-work approach will be followed throughout the course of the project for the construction of all sections of work. The Contractor will be required to complete a first sample for approval by the Engineer. All following works will be based on the approved sample in terms of quality and workmanship. In addition to this the Contractor will be required to construct a small portion of each new pipeline section of works to the satisfaction of the engineer or his representative. All work of similar nature to be executed thereafter will be compared to the approved portion of works in order to obtain final approval by the engineer or his representative.

PS 18 WORKING NEAR THE MAIN RUNWAY

The project also includes construction works near the main Air Force runway. The Contractor must be aware that NO works will be allowed within a 50m distance of the edge of the main and/or secondary runway due to aircraft landing safety precautions. The Air Force Base chief in charge will indicate a period of time when works will be allowed within the 50m safety buffer zone. This will provide the Contractor with sufficient time to complete all planned works near the runway and the Contractor must ensure that all works have been completed and approved by the Engineer or his representative within this timeframe. The allowable construction period will be communicated as early as possible in order for the Contractor to slot the relevant operations into his construction programme for approval by the engineer.

B1: AMENDMENTS TO THE STANDARD SPECIFICATION:

The following variations and additions to the SANS 1200 Standardised Specifications referred to in the last clause of Portion 1 apply to this Contract. The prefix PS indicates an amendment to SANS 1200. The letters and numbers following these prefixes respectively indicate the relevant Standardised Specification and clause numbers in SANS 1200.

PSA GENERAL (SANS 1200 A)

PSA-3 MATERIALS

PSA-3.1 Quality

PSA 3.1.1 Standardisation Mark

ADD THE FOLLOWING:

All material delivered to the site shall bear the Official SANS (SANS) Standardisation Mark.

PSA-4 PLANT

PSA-4.2 Contractors Offices, Stores and Services

PSA 4.2.1 Restrictions on employee accommodation (sub-clause 4.2)

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

No housing is available for the Contractor's employees. The Contractor shall make his own arrangements to house his employees and will not be allowed to have any employees living on the site.

The Employer shall place an area at the disposal of the Contractor to enable him to erect his site offices, workshops and stores. Any temporary housing and facilities shall comply with the requirements of the local authority. The Contractor shall provide his own fencing and site security.

PSA-5 CONSTRUCTION

PSA-5.5 Dealing with water on works

ADD THE FOLLOWING TO THE SUBCLAUSE:

In addition to the items as set out in Sub-clause 5.5 the contractor shall also provide pumping equipment, pipes and other equipment as may be necessary.

PSA-8 MEASUREMENT AND PAYMENT

PSA-8.2 Payment

PSA-8.2.1 Fixed-charge and value-related items

REPLACE THIS SUB CLAUSE WITH THE FOLLOWING:

"Payment shall be a lump sum to provide for the Contractor's expenses in connection with:

(a) setting up and maintaining his organisation, camps and plant on the site;
(b) effecting the insurance's and indemnities required in terms of the General Conditions of Contract
(c) meeting all other general obligations and liabilities which are not specifically measured for payment in these contract documents.

The lump sum total of items (a), (b) and (c) as measured and Fixed Charge Items and Time Related Items shall not exceed **15%** of the nett total Tender Amount. If the Tenderer should tender a higher amount for this item it shall be reduced to the amount allowed above and all other tendered prices increased in the proportion required to retain the same Nett Total Tender Amount.

The tendered lump sum shall not be subject to any variation if the actual value of work done under the Contract exceeds, or falls short of, the Tender Amount, or as a result of an extension of time for completion in terms of **Clause 5.12** of the General Conditions of Contract.

Any payment made under this item shall not be taken into account when determining whether the value of a certificate complies with the "minimum amount of monthly certificate" laid down in the Appendix.

Before any payment is made under this item the Contractor shall satisfy the Engineer that he has provided on site an establishment and plant of good quality and in value exceeding that of the first instalment. The Contractor may be asked to furnish documented proof that he owns the offices and plant on site, the value of which should exceed the amount claimed in the first certificate. In the event that the Contractor cannot satisfy the Engineer as to the value or ownership, the Engineer shall have the right to withhold part of any payments to be made under this item, until the Works have been completed.

Payment of the lump sum shall be made in three separate instalments as follows:

(a) The first instalment, **50%** of the lump sum, will be paid in the first payment certificate after the Contractor has met all his obligations under this sub-clause and has made a substantial start on construction in accordance with the approved programme.

(b) The second instalment, **35%** of the lump sum, will be paid when the value of the work done reaches one half (50%) of the Nett Total Tender Amount.

(c) The third and final instalment, **15%** of the lump sum, will be paid when the works have been completed and the Contractor has fulfilled all requirements of this sub-clause. No payment for the scheduled Fixed Charge Items for this contract will not be made until the requirements regarding and the erection of name boards have been met."

PSA-8.2.2 Time-Related Items

REPLACE THIS SUB CLAUSE WITH THE FOLLOWING:

"Subject to the provisions of 8.2.3 and 8.2.4, payment of item 8.2.2 (time-related item) will take place in equal monthly amounts, calculated on the tendered amount for the item, divided by the contract period in months, with the understanding that the total of the monthly payments which was paid for this specific item does not exceed the proportion that the progress of the works to date bears in relation to the works as a whole.

Should the Engineer grant an extension of time, the Contractor is entitled to an increase in the amount tendered for time related items, and this increase must be kept in the same proportion to the original tender amount as the extension of time is to the original time of the completion of the works.

Payment for such increased amounts will be considered as full compensation for all time related, provisional and general costs which arise as a result of the extension of time.

PSA-8.2.3 Direct supervision of works

ADD THE FOLLOWING TO THE CLAUSE 8.4.3:

Item: Special requirement: The Contractor is to provide full time construction supervision by a written appointed construction supervisor for work in or around sinkholes and dolines. This person shall at no time leave the site during such construction activities.

a) Company and Head Office overhead costs.	Unit: Sum
b) General responsibilities and other time related obligations.	Unit: Sum

The rate shall cover all expenses related to time cost and/or fixed costs incurred by the Contractor for the provision of a professional site supervisor when working in an area identified as a potential dolomitic area with sinkholes and dolines. The site supervisor shall be pre-approved by the client prior to written appointment by the Contractor for full time site supervision.

PSA-8.4.5 Occupational Health and Safety

ADD THE FOLLOWING TO THE CLAUSE:

Item: Provision for the cost related to the Occupational Health and Safety Act, 85 of 1993, and the relevant Regulations:

a)	Preparation of a Health & safety Plan	Unit : Sum
b)	Compilation of a Risk Assessment prior to Construction	Unit : Sum
c)	Health & Safety induction Training of employees	Unit : Sum
d)	Compilation and keeping up to date the Health & Safety file which shall include all documentation required in terms of the act	Unit : Sum
e)	Implementation of the Health and Safety Plan over the entire construction period.	Unit : Sum

Occupational Health & Safety is considered to form part of the Contractor's preliminary and general obligations, and responsibilities under this contract, although it has been separately included as a particular specification with its own scheduled payment items. The tendered sum shall include full compensation for providing the above services as required from the Occupational Health & Safety Act. The rate shall include all related costs incurred by the Act, remuneration of personnel, trainers, etc. and equipment required for the execution of the required services as depicted by the Act. The tendered amount for items a, b, c and d shall only be paid on the successful completion of the task as approved by the client. The tendered amount for item (e) shall be paid on a monthly basis.

PSAB ENGINEER'S OFFICE (SANS 1200 AB)

PSAB-1 MATERIALS (Clause 3)

PSAB-1.1 Nameboards (Sub-Clause 3.1)

ADD THE FOLLOWING TO THE SUBCLAUSE:

2 Name boards are required.

PSAB-1.2 Office Building(s) (Sub-Clause 3.2)

Add the following to the Clause:

In addition to the requirements of Sub-clause 3.2 the following is required:

a. Office Building

One (1) office as well as a meeting facility is required for the Engineer on site. The meeting facility to be of sufficient size and to have a table and chairs to house twelve (12) people comfortably.

The office must also be equipped with Internet Facilities (Wi-Fi) as well as printer/copier for A3 & A4 black & white and colour prints/copies.

b. Carports

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

c. Ablution and latrine facilities

The Contractor shall, in addition to catering for his own staff, provide ablution and latrine facilities adjacent to the Engineer's office for the exclusive use of the Engineer and his staff. The facilities shall consist of a shower with locker room, hand washbasin and a latrine. The facility shall be maintained in a clean and hygienic condition.

d. Heating and cooling facilities (Sub-clause 3.2(j))

The Contractor shall supply and install in the offices and meeting facility an air-conditioning unit with cooling and heating capacity of at least 2 500 k/cal.

e. Refreshments for the engineer and his staff

Tea and/or coffee shall be provided by the Contractor for the Engineer, and the Engineer’s staff, at reasonable intervals throughout any working day for the duration of the construction period.

PSAB-1.3 Standard Specifications

ADD THE FOLLOWING CLAUSE:

A complete bound set of SANS 1200 Standardised Specifications must be made available on site.

PSAB-2 PLANT (Clause 4)

PSAB-2.1 Telephone (Sub-clause 4.1 and 5.4)

ADD THE FOLLOWING TO THE CLAUSE:

In terms of Sub-clause 4.1 a telephone, if possible, shall be installed in the Engineer's Office.

The Contractor shall provide the Engineer with a cellular phone for the duration of the Contract.

The Contractor shall arrange for the installation of the telephone and/or provision of cellular phone and the full amount of telephone accounts shall be payable by the Contractor for the duration of the construction period. The Contractor will be required to bear the cost of the telephone calls made by the Engineer for work related purposes.

An internet facility (Wi-Fi) which can transmit and receive must be installed in the Engineer's Office and shall be linked to an individual telephone line (cellular line, if required). The Contractor shall arrange for the supply and installation all infrastructure. The cost of the supply of the facility shall be included in his tendered rate. Upon completion of the Works the ownership of the Wi-Fi / Internet Modem facility shall revert back to the Contractor.

PSAB-2.2 First aid kit and protective clothing (additional Sub-clause 4.2)

Add the following Clause:

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

The Contractor shall provide two sets of safety helmets and rubber boots for the exclusive use of the Engineer and his staff.

PSAB-3 CONSTRUCTION

PSAB-3.1 Survey Assistant

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

The Contractor shall make available, for the duration of the contract period, when required by the Engineer, one skilled and one unskilled survey labourer.

PSC SITE CLEARANCE (SANS 1200 C)

GENERAL

The areas where work is to be carried out must be kept clean for the duration of the contract. All rubbish must be removed without delay and the site must be left clean and tidy on completion of the service.

The contractor's camp and area of works must stay clean and free of FOD (foreign object debris) at any given time to avoid foreign matter becoming congested in aircraft engines.

Only orange safety netting or hard barricading will be allowed during the construction works for the purposes of safeguarding open trenches, areas of no access, construction works areas, etc. No red/white danger tape may be used.

PSC-3 MATERIALS

PSC-3.1 Disposal of material

ADD THE FOLLOWING TO THE SUBCLAUSE:

No dumping is allowed on site other than at the designated and approved fill areas. Dumping will only be allowed for filling sinkholes and dolines and may not be detrimental to the natural stormwater drainage of the area. Only soil, rock, clean masonry and concrete rubble may be dumped in the designated dump areas. All waste material from excavations and or the removal of redundant pipework shall be stockpiled at a designated locality within the site perimeter. Materials shall be selected and stockpiled on individual piles as instructed by the Engineer. Allowance shall be made by the contractor in his rates for the implementation of such an arrangement.

PSC-5.2 Cutting of trees

PSC-5.2.3 Preservation of trees

ADD THE FOLLOWING CLAUSE:

No trees may be removed without prior permission from the Officer Commanding or the Engineer.

PSC-8 Measurement and payment

PSC-8.2.1 Clear and grub

ADD THE FOLLOWING TO THE SUBCLAUSE (8.2.1):

Item: Clear and grub areas between buildings and structures. Predominantly hand operations.

Unit: m^2

The item shall cover the clear and grub in areas where the use of plant such as graders or scrapers is not an option and clearance shall be done by hand. The rate shall cover all labour and tools required for the execution of the item.

PSC-8.2.2 Clear and grub

ADD THE FOLLOWING TO THE SUBCLAUSE (8.2.1):

Item: Clean channels from rubble, silt and organic material and trim short all grass and weeds 2m either side of the channel.

Unit: m

The rate for cleaning the channels as stated above shall cover all labour, plant, tools, disposal of all rubble and supervision in order to remove any matter inside the channels/canals in order to have a clean and well exposed surface. The rates shall further include the neat making of grass/weed both sides of the canal, 2m from the canal outer edge. Mowing shall be done with a bush cutter to a maximum grass/weed length of 50mm.

PSC-8.2.3 Clear and grub

ADD THE FOLLOWING TO THE SUBCLAUSE (8.2.1):

Item: Clean rubble and debris from stormwater grid inlets and catch pits.

Unit: no

The item shall cover the removal of all debris and rubble from the immediate vicinity of any stormwater related inlet structure or manhole. The unit of measurement is per structure cleaned and the rate offered shall cover the removal of any rubble/debris and the disposal of all rubble/debris as instructed by the engineer. The rate shall include all labour, plant etc. required to execute the work.

PSC-8.2.4 Topsoil

ADD THE FOLLOWING TO THE SUBCLAUSE (8.2.10):

Item: Remove topsoil in confined areas between buildings where hand excavation is required.

Unit: m^3

The rate shall cover the removal of topsoil to a depth of 150mm, stockpile and maintain. The area under discussion is typically areas where the removal of topsoil shall be done by hand. The rate shall cover the replacement of the stockpiled topsoil onto the compacted fill where required, as instructed by the engineer.

PSC-8.2.5 Grass

ADD THE FOLLOWING CLAUSE:

Item: Remove grass in blocks and plant on filled areas. Temporary stockpile, water and maintain prior to placing, as well as water after placing.

Unit: m^2

The rate shall cover the removal of grass in blocks from designated area. The rate includes the stockpiling of these blocks as well as watering of the blocks in order to avoid drying out. The rate also includes the placement of the grass blocks within the free haul distance as instructed by the engineer.

PSDB PIPE TRENCHES (SANS 1200 DB)

PSDB-1 SCOPE

This section covers the excavation for pipe trenches for all the wet services forming part of the scope of works for this particular contract. The pipe trenches are those for water services, sewer services and storm water services and the related excavations for connections to existing services at buildings as well as all valve chambers, water meter chambers, fire hydrants and other inspection and access manholes.

PSDB-5 CONSTRUCTION

PSDB-5.1.2 Stormwater, seepage and dewatering of excavations

ADD THE FOLLOWING TO THE SUBCLAUSE:

Berms shall be constructed on either side of open trenches to prevent the inflow of water during rainstorms.

PSDB-5.6.8 Transport for earthworks for trenches

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

All haulage within the perimeter of the site of works and / or the AFB perimeter wall shall be regarded as freehaul. Haulage beyond this area will be paid for as a separate item.

PSDB-8 MEASUREMENT AND PAYMENT

PSDB-8.1 Basic Principles

ADD THE FOLLOWING TO THE SUBCLAUSE:

The scheduled rates for excavation shall include dewatering of trenches, as well as stock piling all selected excavated material for future use in sink hole and or doline rehabilitation at designated spoil areas within the site.

PSDB-8.3 Scheduled Items

PSDB-8.3.1 Topsoil

Item: Remove topsoil to 150 mm depth, stockpile, maintain, replace and compact to 90% MOD.AASTHO

Unit: m^2

ADD THE FOLLOWING TO THE SUBCLAUSE (8.3.1)

The schedules rate shall include for the removal of topsoil to a depth of 150 mm below the natural ground level on all pipeline routes to the width of the particular excavation required. All topsoil shall be stockpiled and maintained at a designated position within the freehaul distance. All topsoil shall be replaced onto the

trench fill after completion of the installation of any pipeline service. The rate shall include all labour and plant in order to execute the particular activity to the satisfaction of the engineer.

PSDB-8.3.2 Surfaced areas

1) Item: Remove surface areas by square cutting, and dispose of for — Unit: m^2

a) Asphalt sections on pipe route by means of cutting with a diamond tipped pavement cutter
   1) Up to 50 mm in thickness
   2) Above 50 mm up to 100 mm in thickness
   3) Above 100 mm in thickness

b) Concrete slabs:
   1) Up to 100 mm in thickness
   2) Above 100 mm up to 150 mm in thickness
   3) Above150 mm up to 200 mm in thickness
   4) Above 200 mm up to 300 mm in thickness — Unit: m^2

c) Brick Paving:
   Stockpile for re-use. — Unit: m^2

d) Cutting of Brick Paving:
   1) Up to 50 mm in thickness
   2) Above 50 mm up to 100 mm in thickness — Unit: m^2

e) Remove kerbs (up to 350mm high and 400mm wide), stockpile for re-use later. — Unit: m

ADD THE FOLLOWING TO THE SUBCLAUSE

The scheduled rate shall include for the cutting of the above listed items as well as the removal of all debris where services need to be installed. The debris shall be removed to a position indicated by the engineer within the free haul distance. The rate shall cover all labour and plant in order to execute the activities listed to the satisfaction of the engineer.

The rate for the cutting and/or removal of bricks shall include for the stockpiling of paving bricks, the safe keeping of these bricks as well as for the replacement of the stockpiled bricks in the original position to at as surfacing.

PSDB-8.3.3 Hard rock excavations

ADD THE FOLLOWING TO SUB-CLAUSE 8.3.2 b) 2) Hard Rock Excavation

All other excavation other than hard rock excavation is deemed to be soft excavation except boulder excavations which will be considered as hard rock excavation if removed by means of mechanical equipment.

PSDB-8.3.4 Tunnelling under existing walls

ADD THE FOLLOWING PAY ITEM

Item: Tunnelling under fence, electric, palisade, pre-cast or brick or to 1.0m measured horizontally under foundations — Unit: No

i. Water and sewer pipes:

The item includes hand excavation from a distance of at least 1m either side of the existing wall, a maximum width of 500mm and a maximum depth of 1.5m. A HDPE PE100 PN10 pipe of minimum 355mm ND must be inserted in the trench below the wall foundation to serve as a pipe sleeve for the service crossing the boundary wall.

The pipe sleeve is to be placed on a Class B bedding and the service pipe inserted. The space between the pipe sleeve and trench must be backfilled with mass concrete as indicated on drawing **N2281/W/3/005** & **N2281/S/3/003**.

The rate shall cover the cost of all labour for hand excavation, fixing of formwork, supplying concrete, casting of the concrete, backfilling and compaction by hand. The rate shall also cover the reinstating of the area around the structure after completion.

ii. Stormwater pipes:

The item includes hand excavation from a distance of at least 1m either side of the existing wall, a maximum width of 1500mm and a maximum depth of 3.0m.

The rate shall cover the cost of all labour for hand excavation, backfilling and compaction by hand. The rate shall also cover the reinstating of the area around the structure after completion.

PSGA CONCRETE (SMALL WORKS) (SANS 1200 GA)

PSGA-1 SCOPE

This section covers the construction of storm water related works as well as surfacing works such as pavements and walkways.

PSGA-3 MATERIAL

PSGA-3.2 Cement

Note: No air entraining agents shall be used. All concrete shall be compacted by vibrating. Slump as per SANS 1200 GA Clause 5.4 1.2.

PSGA-3.2.1 Applicable Specifications

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

The cement used in the works shall comply with SANS 50197-1 for common cements.

The following types of cement are suitable for use on this project:

CEM I 32,5
CEM II/A-S 32,5
CEM II/B-V 32,5
CEM II/B-W 32,5

Test certificates form an approved laboratory shall be furnished by the Contractor indicating the alkalinity of the cement expressed as the percentage sodium oxide equivalent Na20 + 0.658 (% Ka20)]. Cements with an alkalinity content in excess of 0.60% by mass of the cement shall not be used regardless of whether or not the aggregates are considered to be potentially alkali reactive.

The source of supply for each type of cementitious material shall not be changed during the contract period.

PSGA-3.2.3 Storage of cement

ADD THE FOLLOWING TO THE SUBCLAUSE:

Consignments of cement shall be stored in such a way that they are used in the same sequence as they are delivered on site. Any cement that shows any degree of hydration and setting or which has been stored on site for a period exceeding twelve weeks from the date of despatch by the manufacturer shall be removed from the site of works and replaced at the Contractor's own expense.

PSGA-4 PLANT

PSGA-4.5 Formwork

PSGA-4.5.2 Finish

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

All off-shutter concrete shall be smooth. All surfaces not shuttered shall be wood-floated.

PSGA-4.5.3 Ties

Formwork ties in water-retaining structures shall be of the 12 mm Extended Coil tie with Water-Bar type Form-scaff. No ferrules or ferrule pipes may be used in structural elements of water-retaining structures. The Contractor shall allow in his rates for the specified formwork ties and ensure that his formwork is compatible with these ties.

After removal of plastic spacing cones of the extended coil ties form concrete, the openings in the concrete shall be roughened with a mechanical wire brush. Thereafter the opening shall be painted with cement mortar and filled with a non-shrink grout such as “Standard Bedding Grout” by Samson or a similar approved non-toxic product compatible with the chemicals used in the water. The grout filling shall be applied in such a way as to protect the ties against corrosion.

PSGA-5 CONSTRUCTION

PSGA-5.4 Pipes and conduits

ADD THE FOLLOWING SUBCLAUSE:

The space between pipes and ducts that are to be cast into reinforced concrete and any adjacent reinforcement shall not be smaller than the larger of the following:

a) 40mm, or,
b) 5mm plus the maximum size of the coarse aggregate.

PSGA-5.5.10 Concrete surfaces

a. Unformed concrete surfaces

ADD THE FOLLOWING SUBCLAUSE**:**

Surfaces finished with a trowel shall have no trowel marks on it and cement foam that has been worked to the surface is unacceptable.

b. Concrete Surfaces

ADD THE FOLLOWING SUBCLAUSE:

All unformed concrete surfaces will have a steel float finish unless otherwise specified on drawings or in the schedule of quantities. No measurement for payment shall be made for steel float finishing, as the costs will be deemed included in the concrete rate.

PSGA-6 PERMISSIBLE DEVIATIONS

PSGA-6.2.1 General

ADD THE FOLLOWING TO THE SUBCLAUSE:

All concrete elements must have a degree of accuracy of II.

PSGA-7 TESTING

PSG-7.2.4 Grouting

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m^2 in area unless otherwise ordered.

When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80 % with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95 %. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer. The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved.

Test procedures shall comply with the relevant requirements of Sub-clause 7.2.1 to 7.2.3.

PSGA-8 MEASUREMENT AND PAYMENT

PSGA-8.1 Principles

PSGA-8.1.4 Concrete complete with formwork

ADD THE FOLLOWING CLAUSE TO THIS SUBCLAUSE:

Item: Cast in-situ storm water open drain. Various widths and depths specified separately.

a) Type A (Vehicle traffic loading) Unit: (m)

b) Type B (No vehicle traffic loading) Unit: (m)

The rate of payment shall be per meter of storm water drain/channel constructed complete as per the required detail, section or drawing as specified in the schedule. It shall include for preparation of surface beds (excluding excavation), compaction, formwork, polyethylene sheeting, supplying and casting of concrete (excluding reinforcing) and all specified surface finishes.

PSGA-8.2 Service Ducts

PSGA-8.2.1 Service Ducts in Roads

ADD THE FOLLOWING PAYMENT ITEM:

Item: Cast in-situ service duct with grating over Unit: m

The rate of payment shall be per meter of storm water duct constructed complete as per detail DWG **N/2281/SW/3/004**. It shall include for preparation of surface beds (excluding excavation), compaction, formwork, steel reinforcing, fixing of formwork, polyethylene sheeting, supplying and casting of concrete (excluding reinforcing) and all specified surface finishes.

The rate shall also include the supply and fixing of flat iron anchor, angle iron to seat grating and horizontal steel grating trench cover as well as reinstating the surrounding area after completion.

PSGB CONCRETE (ORDINARY BUILDINGS)

PSGB-8 MEASUREMENT AND PAYMENT

PSGB-8.1 Principles

PSGB-8.1.1. In-situ Concrete

ADD THE FOLLOWING SUB CLAUSE:

Concrete apron

Scheduled item:

Supply all materials and construct concrete apron 150mm thick in Grade 25 Mpa/19mm concrete. Cast in alternate sections of 4m each with an expansion joint on 16m. Wood float surface finish.

Unit: m²

The unit of measurement is metre square as the thickness is specified. The rate shall include for preparation of surface beds, compaction to 90% Mod AAHTO before laying concrete. No additional payment will be made for construction joints or for any extra work needed for placing of concrete to the satisfaction of the Engineer.

The rate also includes for all ancillary form work and surface finishes as specified.

PSL MEDIUM PRESSURE PIPELINES (SANS 1200 LB)

PSL-1 SCOPE

This portion covers the construction of a new sleeved water reticulation supplying water to the existing selected buildings as well as fire water to hydrants and hangar buildings.

PSL-2 INTERPRETATIONS

PSL-2.1 Supporting Specifications

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

Reference is made to PW 344 Appropriate Development of Infrastructure on Dolomite Manual Department of Public Works. August 2017. **Specific attention is given to Annex P: Specification for HDPE Product Supply, Installation and Quality Control**. In the event that there is a direct contradiction between the aforementioned standard specification document and this document's specifications, the former shall take preference.

PSL-2.3 Definitions

Fitting

REPLACE "(EXCEPT WELDING)" WITH ", INCLUDING BUTT WELDING OF HDPE PIPES".

PSL-2.4 Abbreviations

ADD THE FOLLOWING:

"HDPE: High Density Polyethylene".

PSL-3 MATERIALS

PSL-3.7 Other Types of Pipes

PSL-3.7.3 High Density Polyethylene Pipes HDPE

ADD THE FOLLOWING:

PSL-3.7.3.1 General Requirements

HDPE pipes shall comply with the requirements of SANS 4427 / ISO 4427. Pipes shall preferably be joined by means of butt welding as per the requirements of SANS 4427 but mechanical joint compression fittings complying with the requirements of SANS 14236 / ISO 14236 may also be used where permitted. Where permitted in terms of the specification data, pipes may be joined together by means of suitable push fit, heated tool socket weld or electro fusion fittings recommended by the pipe manufacturer or butt fusion.

HDPE pipes may be supplied and stored in coils provided that the diameter of the coil is at least 24 times the pipe diameter or 600mm.

Supply lengths:

12m (minimum) (except: Up to 90mm diameter pipes should preferably be supplied in 100m rolls and 110mm diameter pipes in 50m rolls).

PSL-3.7.3.2 Quality Assurance

It is the responsibility of the manufacturer/supplier to establish Quality Assurance by means of quality control procedures, which shall ensure that the product will meet the requirements of this specification. The manufacturer/supplier shall maintain a quality system that conforms to the requirements of SANS 9001 / ISO 9001:2015 or national equivalent. Applicable standard for manufacture of pipe shall be SANS 4427 / ISO 4427.

For all relevant requirements, certification or testing that may be necessary for quality assurance of raw material supply, manufacturing standards, equipment used in manufacturing or tests to ensure standards are met, refer to SANS 4427 / ISO 4427, SANS 10268, SANS 10269, SANS 10270, SANS 1655, SANS 1671, SANS 21138, SANS 674, ISO 9969 and relevant specifications.

The manufacturer/supplier shall submit the following documents prior to delivery of material to site:

- Certificate of Registration - SANS 9001/SANS ISO 9001:2015 or National equivalent;
- Permit Certification - SANS 4427/SANS ISO 4427 for PE100;
- Quality Control Plan (QCP shall include Raw Material and Product Test Certificates);
- Last two audit reports according to SANS or National equivalent.

The manufacturer must unconditionally guarantee all HDPE products for a period of 100 years against any form of chemical decomposition or mechanical failure as a result of normal use in a 100-year lifecycle of expected pressures.

PSL-3.7.3.3 General Product Requirements

PSL-3.7.3.3.1 General

All finished HDPE products shall be free from cracks, voids, foreign inclusions and other defects, which would impair the overall performance. It shall be smooth walled on inside and outside and shall conform to the requirements (characteristics) outlined below.

PSL-3.7.3.3.2 Characteristics of Raw Material

Raw Material: the HDPE manufacturing substance shall be 100% SANS ISO 4427 PE100 High Stress Crack Resistance certified virgin material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall have been tested in accordance with the ISO13479 Notched Pipe Test by an independent 3rd party laboratory and the time to failure shall have been ≥8,760 hours. HDPE structured wall manufacturing substance shall be 100% SANS ISO 4427 PE100 certified material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall be subjected and proved to be conforming to testing means and methods specified in SANS 4427.

Raw material declaration: the HDPE product manufacturer must declare in the tender documents the origin (supplier) of the raw material that will be used to manufacture the pipes for the contract. Raw material composition for pipes, fittings (e.g. stubs) and other elements (e.g. sheeting for benching) shall be PE 100 pre-compounded black.

Ash content: To be in accordance with SABS 533 part 1,2 and 3 clause 6.3 maximum not to exceed 0,1%(m/m).

PSL-3.7.3.3.3 Technical Specification for Raw Material and Finished Product

Physical/Chemical Property	Standard	Value	Unit
Density	ISO 1183	0,949 – 0,960	g/cm³
Melt Flow Index (190°C/5kg)	ISO 1133	0,25 – 0,35	g/10min
Vicat Softening Point	ISO 306	64 – 68	°C
Crystalline Melting Range	ISO 3146-85	130 – 135	°C
Viscosity Number	ISO 1628-3	390	cm³/g

Mechanical Property	Standard	Value	Unit
Shore D, Hardness	ISO 868	61	–
Elastic Modulus	ISO 527	900	MPa
Tensile Yield	ISO 527 / ISO 6259	24	MPa
Ultimate Tensile Strength	ISO 527 / ISO 6259	35	MPa
Ultimate Elongation	ISO 527 / ISO 6259	>600	%
Flexural Stress (3.5% Deflection)	ISO 178	19	MPa
Thermal Stability (OIT @ 210°C)	ISO 10837	≥20	minutes
Carbon Black Content	ASTM D 1603 / ISO 6964	2,25 +/- 0,25	%

PSL-3.7.3.3.4 Pipe Characteristics

Characteristics	Applicable Standard
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness @ any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

PSL-3.7.3.4 Fittings and Specials

All HDPE fittings and specials shall be **moulded** from pipe complying with the requirements of PSL-3.7.3.1. In addition, all pipe fittings and specials shall be free of weld spatter and all sharp corners and edges shall be chamfered smooth.

Welders who are competent in terms of the relevant procedure approval test shall carry out all welding and proof of such competency may be required by the Engineer.

PSL-3.7.3.5 GRP Pipes

GRP pipes and jointing systems shall comply with the requirements of SANS 1748-1 and, unless otherwise specified in the specification data, have a nominal pressure (PN) class of 12, a pipe stiffness (SN) class of 630 and be certified for conveying potable water.

PSL-3.7.3.6 Steel Mesh Reinforced PE Pipes

Steel mesh reinforced polyethylene (PE) pipes shall comply with the requirements of SANS 370 and a have a PN 16 nominal pressure rating for pipes with a diameter of up to 160mm. Such pipes shall be joined by means of either an electrofusion coupling or flanged fitting complying with the requirements of SANS 371.

PSL-3.7.3.7 Polypropylene

Polypropylene pipes shall comply with the requirements of SANS 15874 and shall be class PN10 for pipes with a diameter of up to 160mm.

Polypropylene pipes shall be joined together by means of mechanical joint compression fittings complying with the requirements of SANS 10268. Pipes may be joined together by means of suitable heated tool socket weld fittings recommended by the pipe manufacturer or butt fusion.

PSL-3.7.3.8 uPVC pipes

uPVC pipes shall be stored, handled and transported in accordance with the requirements of SANS 10112. uPVC pipes and fittings shall comply with the requirements of SANS 966-1 and, in the case of pipes with a diameter up to 160mm shall be Class PN10. Pipes may be joined by means of rubber ring joints or solvent weld joints.

PSL-3.7.3.9 Copper Pipes and Fittings

Copper pipes shall comply with the relevant requirements of SANS 460, and fittings shall be mechanical joint compression fittings complying with the requirements of SANS 1067-1.

PSL-3.7.3.10 Galvanized Mild Steel Pipes & Fittings

All pipes and fittings' supply and fit, SABS 509 approved hot dipped galvanised to SABS 763, Mild Steel, Class Medium. All flanges are to be drilled to SABS 1123 Table 1600/3. (FAE = flanged all ends).

PSL-3.7.3.11 Jointing of HDPE Pipe

Jointing of HDPE solid wall piping shall be by means of welding as specified in SANS 10268-1 (Heated tool welding). All welding shall be carried out by the manufacturer or through an approved sub-Contractor with a proven track record for welding of HDPE pipes and all completed welds must be documented.

Electrofusion welding of pipes will only be allowed in specific cases where butt welding by means of a heated tool is not practically possible and upon prior approval by the engineer.

PSL-3.8 Jointing Materials

ADD THE FOLLOWING:

PSL-3.8.3 Flanges and accessories

Unless otherwise scheduled the dimensions and drilling of standard flanges shall comply with the requirements of SANS 1123 Table 1600/3. Flanges shall be machined flat i.e. without a raised joint face.

The type, drilling pattern and sizes of flanges jointing to existing flanges shall match the existing pipe flanges and shall be determined on site.

Faces of flanges which will be in contact with jointing gaskets shall receive protective coating similar to the corrosion protection specified for the internal surface of the pipes and fittings and of such thickness and consistency as will not impair the air/gas/water tightness of the joints.

PSL 3.8.3.1 Pipe Joints

All properties of pipe joints designed by the manufacturer must always exceed or be equivalent to the base parent pipe (i.e. joints shall not decrease the tensile strength properties of the overall pipeline.)

PSL-3.9 Corrosion Protection

ADD THE FOLLOWING:

PSL-3.9.5 Joints, bolts, nuts and washers

After successful testing of pipelines, all flanged and welded joints, slip-on and shoulder-end type couplings (inclusive of bolts, etc) shall be thoroughly cleaned and two coats of approved bituminous paint shall be applied on all exposed surfaces.

PSL-3.9.6 Corrosive soil

Where indicated on the relevant drawings, protective tape wrapping shall be applied to pipes, flanged and welded joints and slip-on type couplings in addition to any other protective coating specified. In addition, and as ordered by the Engineer, a protective wrapping shall also be applied to the pipelines.

The tape shall be applied with a 50% overlap and in the case of joints, the wrapping shall extend for at least 100mm on either side of the joint. The tape shall consist of a petrolatum impregnated tape, with nylon, fibreglass or similar material web. The minimum thickness of the tape shall be 1,0 mm and the minimum tensile strength shall be 4,4 kg/cm width. The tape shall be suitable for both machine and hand application. In addition, the tape shall be chemically resistant to all common acids and alkalis normally encountered and in particular those prevailing on the site.

PSL-3.10 Valves

REPLACE THIS CLAUSE WITH:

Valves to be used shall comply with the following:

(a) Resilient Seal Gate Valves (RSV)

All gate-valves shall comply with the requirements of SANS 664 and shall carry the SANS mark. Tenderers must provide a brief overview on their company with particular emphasis on service capabilities, calibration facilities and their track record in South Africa.

RSV's shall be double flanged with non-rising spindle and shall conform to the requirements of SANS 664 for working pressures as specified for each application. Spindles shall be stainless steel with bronze nuts. The valve body and bonnet shall be spheroidal graphite, grey cast or ductile iron. The direction of closing, which shall be clockwise when viewed from above, must be clearly indicated on the bonnet or on the hand wheel of each valve.

The valve shall have a straight through pocket free passage and shall have a replaceable gland assembly consisting of at least two O-rings, which can be replaced under pressure. A wiper ring to prevent the ingress of dirt shall be provided. The gate shall be fully encapsulated with a Nitrile Butadine rubber sheath fully bonded to the gate by vulcanizing. Valves shall internally and externally be coated with a fusion bonded epoxy coating of 200-micron minimum thickness. Valves are required to seal drop tight from zero to a test pressure of 1.5 times the rated working pressure under test and field conditions.

The valve shall be capable of being opened and closed under an unbalanced pressure equal o the rated working pressure.

The valve shall operate via a cap top (or hand wheel where specified).

(b) Air valves

Air valves shall be cast in iron or stainless steel bodied and of the single-chamber design with cylindrical solid polymer control floats incorporating an anti-shock design during high velocity air discharge. The orifice plate, internals and body bolts shall be stainless steel. All components of the valve shall be easily replaceable.

The design of the valve shall be such as to preclude the loss of water or the possibility of the float being blown shut by the passage of air when the accumulation of air in the pipeline is being released.

The valves shall respond to the presence of accumulated air under normal working conditions by discharging it through a small orifice at any pressures within the specified design range.

Valves shall react immediately to pipeline drainage by full opening of the large orifice to allow unobstructed air intake. Valves shall not exhibit leaks or weeping past the large orifice seal at the maximum working pressure.

The working pressure rating of the air valves shall be 1600 kPa unless otherwise indicated.

Air valves shall be supplied complete with double flanged (RSV) isolating valve for the shutting down of the air for servicing.

PSL-3.11 Manholes and Surface Covers

PSL 3.11.1 Precast Cylinders

Change the title to “Prefabricated Cylinders” and add the following:

For dolomite underlain land manholes, inspection chambers and surface boxes shall preferably be manufactured from structured or solid wall HDPE or steel-reinforced spirally wound HDPE pipes and shall be watertight.

HDPE structured wall pipes shall be manufactured according to SANS 21138 or SANS 674 in terms of profile, pipe fittings and pipe endings, but with stainless steel stiffeners and 5mm minimum wall thickness.

HDPE solid wall pipes shall be manufactured according to SANS 4427. Ring stiffness shall be tested according to ISO 9969 with:

i. 8,0kN/m² ring stiffness for all depths
ii. 4,0kN/m² ring stiffness for depths ≤1,5m where approved.

HDPE pipes to be extrusion welded to the manhole.

Benching shall consist of HDPE (PE100 to SANS 4427) flat sheet and pipe of minimum 12mm thickness.

PSL 3.11.2 Step Irons

Add “or HDPE, as appropriate” at end of sub-clause.

PSL 3.11.3 Manhole Covers and Frames

PSL 3.11.1.1 Covers for HDPE Manholes, Chambers and Surface Boxes

For HDPE manholes, inspection chambers and surface boxes, the manhole roof shall be an integral part of the chamber wall to form a watertight chamber. The cover (lid) shall be lockable.

PSL-3.12 Hydrants

ADD THE FOLLOWING:

Fire hydrant valves must be tamper proof with 65mm or 100mm double aluminium alloy, quick coupling as specified, that complies with the applicable requirements of SANS 1128 : Fire Fighting Equipment, Part 1 & 2 : Components of Underground and Aboveground Hydrant Systems and must be equipped with a square stainless steel spindle on which the keys of the local fire brigade fit. They must further comply with

NBR 85 section T, No 9613, dated 1 March 1985. Flanges of fire hydrant T-pieces must be drilled in accordance with SANS 1123, Table 1600. After installation, fire hydrants must be painted with one undercoat of zinc chromate to SANS 679 followed by two coats of medium yellow high gloss paint to SANS 630.

PSL-3.13 Water Meter and Automatic Reading Specification

ADD THE FOLLOWING:

PSL-3.13.1 In line through-flow mechanical meters

Water meters tendered for under this category, for sizes NB 40mm up to and including NB 300mm, must be SABS Class B approved, in-line through-flow Woltman type, mechanical turbine flanged bulk water meters for the measurement of cold, potable water and must conform to the following dimensions and specifications:

Nominal Bore	Flange Specs	Working Pressure Maximum	Temp Maximum
40mm	BS4504 Table 16*	1600kPa	50°C
50mm	BS4504 Table 16*	1600kPa	50°C
80mm	BS4504 Table 16*	1600kPa	50°C
100mm	BS4504 Table 16*	1600kPa	50°C
150mm	BS4504 Table 16*	1600kPa	50°C
200mm	BS4504 Table 16*	1600kPa	50°C
250mm	BS4504 Table 16*	1600kPa	50°C
300mm	BS4504 Table 16*	1600kPa	50°C

*BS4504 Table 16 is equivalent to SABS1123 Table 1600/3

All mechanical water meters supplied in terms of this contract shall perform to an accuracy of better than ± 2% error over the meter's operating range; i.e. between Qt and Qp (Qn). The performance characteristics of the meters offered must be equal to or better that the values listed below:

The performance characteristics of the meters offered in this category must be equal to or better than the values listed below.

Size DN	Q_{start} m^3/h	Q_{min} m^3/h	Q_t m^3/h	Q_n (Q_p) m^3/h	Q_{max} (Q_s) m^3/h
40 mm	0.15	0.3	0.8	40	60
50 mm	0.15	0.3	0.7	50	90
80 mm	0.25	0.5	0.8	120	200
100 mm	0.25	0.8	1.8	230	300
150 mm	1.0	1.8	4	450	600
200 mm	1.5	4	6	800	1200
250 mm	3.0	6	11	1250	1600
300 mm	8.0	12	15	1400	2000

PSL-3.13.2 Ultra High Performance Woltman type, mechanical, turbine, flanged bulk water meters:

Water meters tendered for under this category, for sizes NB 50mm up to and including NB 150mm, must be SABS Class C approved, in-line through-flow Woltman type, mechanical turbine flanged bulk water meters and must conform to the following dimensions and specifications:

Nominal Bore	Flange Specs	Working Pressure Maximum	Temp Maximum
50mm	BS4504 Table 16*	1600kPa	50°C
80mm	BS4504 Table 16*	1600kPa	50°C
100mm	BS4504 Table 16*	1600kPa	50°C
150mm	BS4504 Table 16*	1600kPa	50°C

*BS4504 Table 16 is equivalent to SABS1123 Table 1600/3

All combination mechanical water meters supplied in terms of this contract shall perform to an accuracy of better than ± 2% error over the meter's operating range; i.e. between Qt and Qp (Qn). The performance characteristics of the meters offered must be equal to or better that the values listed below:

Size DN	Q_{start} m³/h	Q_t m³/h	Q_n m³/h	Q_{max} (Q_s) m³/h
50 mm	0.03	0.13	35	55
80 mm	0.04	0.25	63	120
100 mm	0.065	0.4	100	160
150 mm	0.12	0.63	250	400

PSL-3.13.3 General

Meters shall be equipped with "intelligent" registers which facilitate "AMR" (Automatic Meter Reading).

In practice, it must be possible to extract readings from the bulk water meters using a Handheld Meter Reading Device (HMRD), which will be able to wirelessly read the reading on the register, without the meter reader having to enter the meter pit. The meter reader approaches each meter which is to be read, and the meter reading is updated automatically onto a handheld or laptop in their possession. After random or planned readouts, the data must be transferable to a personal computer (PC) which is loaded with purpose-written software, for the evaluation of the readings.

As a minimum the system must conform to the following requirements:

(a) A wireless reading system for the meters will be utilized.

(b) The meter registers housing the electronic components, must be waterproof to IP68 using glass/copper materials.

(c) The meter registers will be digital, 9-digit counters for ease of reading in the event of the wireless system malfunctioning.

(d) The battery built into the register will have an extremely long life of at least 10 years.

(e) It must be possible to obtain the following read-out values from the meters:

- The actual meter reading – i.e. the progressive total.
- The factory-assigned serial number of the meter.
- An hourly log of readings for the last 4 months – i.e. the progressive total as self-recorded by the register every hour, irrespective of whether the meters were read or not.
- An hourly log of alarms for the last 4 months such as leak and burst pipe, as well as battery alerts should the battery of the electronic register be running low
- A monthly log of readings for the last 24 months.

(f) Purpose-written software, which operates under the Windows® platform must be available for the downloading of the data to a PC and for the management and evaluation of the data. It must furthermore be possible to convert data into ASCII format for export into other programs.

The software must provide for pre-programmed route planning and random readout capabilities. It must also provide basic evaluation and management tools for statistical information on consumption patterns.

No consideration will be given to meter types which necessitate the use of special tools or fitment of any form of gland in the process of connecting pulser units, or meters which require a register-change to switch from one volume unit per pulse to another. Tenderers are to provide full details of these aspects with their tenders.

Tenderers must provide details of the capacity of meters to measure forward and reverse flow and the pulser types, which can be offered for logging flows in both directions. This requirement is not applicable to compound meters.

Meters must be suitable for installation in the horizontal attitude. Meters offered must require no more than three DN straight pipe upstream of the meter, to ensure that the accuracy of the meters remain within the stated limits, under normal operating conditions.

The performance of the meters offered shall not be affected by outside magnetic influences.

All meter bodies must be drilled and tapped, for connecting a pressure transducer, for data logging on the upstream side. It must furthermore be equipped with the ¼”SS316 quick-release-coupling female half for connecting the data-logger pressure transducer.

Tenderers shall provide details of any approvals which they may have from any authority, locally or overseas, permitting them to exchange meter mechanisms – or to fit new, calibrated mechanisms into used or existing meter bodies, without loss of measuring accuracy.

Cover bolts must be of stainless-steel material to facilitate easy removal of mechanisms. Meter bodies must be coated with a high-quality sintered epoxy powder coating (min 300 µ), both internally and externally, to provide maximum protection against corrosion.

Details of head loss across the meters offered must be provided.

Tenderers must provide details of strainers, which can be offered by them, to protect the meters against possible damage as a result of foreign matter in the water.

Tenderers must provide a brief overview on their company with particular emphasis on service capabilities, calibration facilities, ISO 9001:2015 registered, accredited and their track record in South Africa.

PSL-3.14 Strainers

ADD THE FOLLOWING:

Strainers shall be provided to protect water meters from damage b any large particles and shall be compatible with the meter and shall have a minimum pressure rating of 1600 kPa. Flanges shall conform to the dimensions and be drilled in accordance with Table 1600/3 of SANS 1123.

The body shall be cast-iron or fabricated steel. The sieve element shall consist of stainless-steel mesh with one FBE coating to prevent cationic action. Coating and lining FBE (300 µm). The body shall have a ¼" female SS316 topping on the upstream. Details of head loss across the strainers must be provided together with the specifications for the Engineer's approval before purchase.

PSL-4 PLANT

PSL 4.3 Testing

ADD THE FOLLOWING SUBCLAUSE:

All testing equipment shall be calibrated and shall be accompanied by a valid calibration certificate.

PSL-5 CONSTRUCTION

PSL-5.1 Laying

PSL-5.1.3 Keeping pipelines clean

ADD THE FOLLOWING:

The interior surfaces of all pipes, specials, valves and fittings shall at all times be kept free from dust, silt, foreign matter, and access by rodents, animals and birds shall be prevented. Pipes and specials shall not be used as shelters by staff or for the storage of garments, tools, materials, and food containers or similar goods. Particular care shall be exercised at all times to prevent faecal contamination of pipe interiors by staff, casual visitors or passers-by.

Metal night-caps approved by the Engineer shall be used to close off all ends of each laid section of pipeline when work is stopped at the end of the day or for longer periods and shall be left on the ends of sections of completed pipework until such sections are tied-in with the remainder of the completed pipeline.

Notwithstanding the use of night-caps the Contractor shall at his own expense, make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter.

The Contractor shall at his own expense and to the satisfaction of the Engineer, clean the interior of the pipeline of such contaminants, failing which, the Engineer may order the Contractor to remove the pipes from the trench and replace them with clean pipes at his own cost.

PSL-5.1.4 Depths and cover

ADD THE FOLLOWING SUBCLAUSE

For HDPE, GRP and PVC pipes the minimum soil cover shall be:

Average	: 750mm
Outside traffic areas	: 600mm
Inside traffic areas	: 1000mm

Where these minimum thicknesses cannot be met appropriately designed concrete slabs shall be used as protection or if imposed loads necessitate protection.

PSL 5.2 Jointing Methods

ADD THE FOLLOWING SUBCLAUSE:

Butt-welding of pipes and fittings:

(g) Field welding of HDPE pipes and fittings shall comply with all relevant requirements as specified by SANS 10268-1 (Heated tool welding). Field and factory welding shall be executed by personnel qualified to execute such welding. The equipment utilised shall be as specified in SANS 1671-1.

Electrofusion welding of pipes will only be allowed in specific cases where butt welding by means of a heated tool is not practically possible and upon prior approval by the engineer.

PSL 5.2.5.1 Welding of HDPE

The welding of HDPE using the heated tool butt welding and heated tool socket welding processes shall be undertaken in accordance with the requirements of SANS 10268-1 using equipment that satisfies the requirements of SANS 1671-1.

The welding of polyethylene and polypropylene pipes by means of electro fusion shall be in accordance with the requirements of SANS 10268-2. The acceptability of the weld shall be assessed in accordance with the assessment table contained in SANS 10268-10.

Welders shall, where specified, be tested and certified in accordance with the requirements of SANS 10269 and be in possession of a valid test certificate. Welders shall be trained by a registered Mersita training facility with a minimum NQF 3 qualification.

Before use, metal heating plates shall be cleaned of all traces of polyethylene remaining from previous operations to avoid inclusion of oxidized polyethylene in the weld.

The pipe ends of all pipes jointed by means of an electrofusion fitting shall be prepared prior to jointing by scraping off any surface oxide and being thoroughly cleaned with a suitable cleaner. Angle grinders shall not be used for preparing surfaces.

The two elements that are to be jointed in the butt-welding process shall not be under tension or lateral stress during the welding operation.

PSL 5.2.5.2 Removal of HDPE Pipe Shavings

During the preparation phase of welding surfaces all care must be taken to ensure that pipe shavings are not left behind in pipes. This is of particular importance in terms of the preparation of water pipes. No system with a diameter smaller than 32mm may be connected to the main reticulation unless the main reticulation is thoroughly flushed. The same applies to the entire smaller systems prior to the installation of water meters. The portion of pipe work to individual buildings must also be flushed in reverse from pressure sustaining valves towards the meter prior to connection of the meter.

The entire system should be monitored for blockages after installation and the Engineer shall introduce measures to ensure that the rectification of blockages remains the responsibility of the Contractor for the duration of the contract up to final delivery.

PSL 5.11 HDPE Product Supply, Installation and Quality Control

PSL 5.11.1 Off-loading of Pipes and Fittings

The manufacturer's instructions regarding the off-loading of all HDPE pipes, fittings and manufactured items must be strictly adhered to. The specifications of such procedures must be in the site office of the contractor at all times. The Engineer must be provided with a copy of such procedures.

The Contractor must clear an area specifically for the purpose of off-loading HDPE products. This area must be free of rocks, boulders or any other foreign objects that may puncture, cut or scar the HDPE fittings, pipes and other manufactured items. The area must also be relatively level in one direction and the ponding of stormwater must not be permitted. The area must be kept in such condition for the duration of material being on site.

PSL 5.11.2 Handling of Pipes on Site

The manufacturer's specification for the handling and transporting of material on site must be strictly adhered to. The Engineer shall write a specific instruction regarding this in the absence of such a manufacturer's instruction.

Under no circumstances shall the dragging of pipes on site be allowed. Dragging of the pipe will result in cuts, scratches and puncture marks that may result in weakening of the pipe. Welded pipes shall be transported to the point of installation in accordance with the manufacturer's specification.

PSL 5.11.3 Visual Inspection of Pipes for Defects

The Engineer will inspect all HDPE pipes for any visual defects such as cracks, deformation, wall thinning, etc. This in no means constitute approval of the pipes. It merely serves as an additional quality control feature to ensure that pipes with obvious defects are rejected from the beginning.

Pipes found to have such defects must also be brought under the attention of the supplier in writing. The suppliers must respond in writing. Copies of such cases must be forwarded to the Engineer. In the event of not resolving such cases the matter must be referred to the Technical Committee of the South African Plastic Pipe Manufacturing Association (SAPPMA) for comments in terms of SABS ISO 4427: 1996.

PSL 5.11.4 Pipe Marking

All HDPE Pipes shall be indelibly marked at 1-meter intervals with the following details:

Reference Item	Mark Printed
Trade name	Manufacturer/Supplier Name
Specification	ISO 4427 / SANS 4427
Pipe OD	e.g. 160
Pipe OD tolerance	Grade B
Wall thickness	e.g. 7.7
Nominal pressure	e.g. PN 10
Material designation	PE 100
Batch no.	Manufacturer/Supplier Trace ability
Application	SEWER or WATER or STORMWATER or “SLEEVE-WATER” or any other application

PSL 5.11.5 Inspection of Installed HDPE Pipes by Engineer

The Engineer shall be notified to inspect all HDPE pipes and fittings 24 hours prior to backfilling of trenches. All pipes with cut, scratch, puncture marks or signs of deforming will be rejected from a quality control perspective. In such cases the Contractor must submit a certificate of approval from the pipe supplier. This document must clearly state that the supplier approves the integrity of the pipes irrespective of the noted damages. If such an approval certificate is not supplied, the Engineer reserves the right to reject such parts of the installation as he/she sees fit.

Any dispute in this regard must be referred to the Departmental Project Manager.

PSL 5.11.6 Temporary Connections

All temporary connections to water systems shall not be backfilled unless with the express instruction, in writing, of the Engineer. The installation shall, as a rule, be left open and barricaded as per the contractual standards until the permanent connections are made.

PSL 5.7 Manholes

PSL-5.7.1 General

ADD THE FOLLOWING SUBCLAUSE:

All manholes and chambers for fittings, connections, and valves shall be either prefabricated (in a factory or controlled environment) HDPE manhole chambers or reinforced concrete manholes as indicated on the detail drawings.

HDPE manholes shall consist of a HDPE PE100 SN8 pipe shaft (minimum 8kN/m^2 ring stiffness as per ISO 9969), openings in the correct positions to allow for the connection of a sleeve pipe onto the manhole shaft. The manhole shall also be fitted with factory fitted steps in a staggered pattern and spaced 250 mm centre to centre. The manhole shall be completely water tight and shall be constructed as per detail drawings attached.

PSL-5.7.3 Connection with existing pipelines

ADD THE FOLLOWING:

The work includes the location of the exact position of the existing pipes to be connected. Before any pipe fittings and accessories for connecting with existing pipelines re ordered, the precise dimensions of the existing pipe shall be determined on site. The method of cutting into the existing pipe, the special pipe fittings to be used as well as the dimensions of the pipe fittings shall be determined in consultation with the Engineer.

Where supply pipelines are involved, a suitable date for the connection at each existing pipe must be arranged beforehand with the Engineer and the Works Manager. In order to accommodate operation aspects, it may be necessary that connections be made during the night, over week-ends or even on Sundays. The Contractor must ensure that all materials and accessories are available on site when starting with such operation in order to complete the work within the shortest possible time.

PSL-5.11 Pipeline Shut-down

ADD THE FOLLOWING:

The following procedure shall be followed during the planned shut-down of the pipe systems:

(a) Proceed with the planning of the shut-down and valve or meter replacement operation in conjunction with the Engineer and Employer's staff, using the pro-forma for a shut-down plan included in this document as a minimum requirement. Orders for new valves or meters, fittings, accessories and specials required for this work shall be placed by the Contractor with the least delay.

(b) Arrangements must be made for a shut-down meeting with the Engineer and the Employer's staff, to present and discuss the shut-down plan.

(c) Following acceptance of the shut-down plan, the Contractor shall submit written application to the Employer for the shut-down on the relevant format, taking account of the notice period required, and make arrangements to liaise with and to notify communities affected by the planned shut-down.

(d) Any shut-down plan shall ensure that the section of the reticulation to be closed, is out of commission for a minimum period of time which shall not exceed eight hours. The Contractor shall, before committing himself (and the Employer) to a course of action by cutting a pipe or removing a valve or meter, etc, ensure that replacement valves, PRV or meter, specials, fittings and all other items of material necessary for the completion of the work, are delivered to the point where the valve or meter is to be replaced, dimensions have been checked and pre-assembly has been done. In addition the Contractor shall ensure that all plant, tools, staff, equipment and standby equipment is available and operational, to successfully complete the work in a single continuous work session, and to deal with any contingencies that may arise.

(e) The Contractor shall carry out two re-inspections of the completed installation at 12 hours and 36 hours after re-commissioning to check for leaks.

(f) The Contractor shall be prepared to co-operate with other Contractors executing work of a similar nature and shall be responsible for co-ordination of work activities when required the execution of work at the station under consideration.

PSL-7 TESTING

PSL-7.1 Initial tests on welded HDPE pipes and fittings

ADD THE FOLLOWING:

All welding of HDPE piping shall be as specified in SANS 10268 – Part 1 (Hand tool welding) and which will be subject to acceptance testing in accordance with SANS 10268 Part 10, assessment class 1 (Weld Defects). The Contractor must institute an acceptable quality control and monitoring procedure so that accurate records are kept for all welds. **Weld records include pipe section info, date, time, welding operator, GPS coordinate and photograph of weld.** The control of welding procedure is solely the responsibility of the Contractor and adequate provision must be made in the priced rates to accommodate the quality control.

Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSL-7.2 Standard Hydraulic Pipe Test

PSL-7.2.4 Testing of HDPE pipe sections

PSL 7.2.4.1. General

Testing as contained in ISO 4427 / SANS 4427 shall apply. Tests shall also be conducted ad-hoc by a registered and authorised testing body as approved by the Department of Public Works.

PSL 7.2.4.2. Raw Material Acceptance Tests

The material used for the production of the pipes and fittings or structures shall be high-density polyethylene (HDPE) PE 100. To confirm the quality of this product, the following tests shall be performed:

- Density
- Melt Flow Index
- Carbon Black content
- Carbon Black distribution

PSL 7.2.4.3 Testing of HDPE welding

For weld joint evaluation, water pipes are classified as Assessment Class I, according to SANS 10268-10. Tests on welds shall be performed according to the requirements of SANS 6269 and all pipe system weld factors shall be ≥1.

The Contractor shall submit to the Engineer the results of tensile, bend and peel tests performed according to SANS 6269 by the manufacturer on each batch of HDPE pipe delivered to site.

The Engineer shall visually inspect all welds on site, including welding rod property evaluation as required.

The Engineer shall have 1% of all welds performed removed (sampled) and tested for tensile strength according to SANS 6269 by an approved independent and accredited testing facility.

PSL 7.2.4.4 Pressure testing of HDPE pipes in Laboratory

The Contractor shall provide for quick pressure testing of all pipe sizes delivered to site with at least:

- One test per 500m of pipe having a diameter less than 75mm (OD).
- One test per 250m for all pipes having a diameter exceeding 75mm (OD).

The pressure test involves:

- Selection of 3 samples, at random by the independent test laboratory, of pipes having a minimum length of 1,0m with all relevant pipe markings on and free of scratches and defects.
- Conditioning of the pipe or fitting in water for 12 hours at 20°C.
- Standard pressure test procedures according to ISO 4427.
- Failure test: apply internal pressure at 5bar/min until failure - PE 100 pipes must reach a pressure of at least twice the Minimum Required Strength (MRS) as per ISO 4427 / SANS 4427.
- Upon failure of the test procedure as described above, standard pressure test procedures as per SABS ISO 4427 must be applied.

PSL 7.2.4.5 Permissible Leakage Rates

The permissible leakage rate shall be zero.

PSL 7.2.4.6 Testing of HDPE Pipe Sections

All completed pipelines shall be satisfactorily tested hydrostatically and no payment in respect of pipe laying or the supply of pipes and fittings on any section of pipeline shall be made until such tests have been completed successfully.

Hydrostatic tests shall be carried out on approved completed pipe sections with suitable length as approved by the Engineer.

The Contractor shall be responsible for arranging all aspects of hydrostatic testing and for the supply of all equipment, materials and labour required.

The water mains shall be carefully and slowly charged with potable water supplied by the Employer, until all air is expelled and shall then be left full for at least 48 hours before pressure testing is commenced.

Joints shall remain exposed during testing. Except where unavoidable, testing shall not be carried out against closed valves and the Contractor shall make provision for the installation of blank flanges to comply with this requirement. Care shall be taken to strut and support the mains wherever necessary during testing such as the end of pipelines, at bends etc.

The pressure shall be applied by a manually operated force pump or by a power-driven pump, which should not be left unattended during testing. The Contractor shall ensure that pressure gauges are accurately calibrated before testing commences and precautions shall be taken to ensure that the required test pressures are not exceeded. Means of measuring the quantity of make-up water pumped into the pipelines during testing shall also be provided.

The test pressure for field testing shall be 1,5 times the maximum working pressure.

The test pressure applied over any section under test, taking any differences in elevation along the pipeline into account shall be such that the pressure at any point along the section is not more than 1,5 times the maximum working pressure of the pipe.

The pump shall maintain the test pressure as described above and during this period all joints shall be carefully inspected for signs of leakage. The test procedure shall be as follows:

- Fill the pipe section with potable water and leave overnight;
- Gradually increase the pressure over a period of 3 hours to 100% of the maximum working pressure;
- Inspect the pipe for visual leaks and should leaks be observed, gradually decrease the pressure to zero and repair the leaks;
- Repeat the last two steps until no visual leaks occur;
- Then increase the pressure to 150% of the maximum working pressure and close the valve to maintain the pressure. After one hour measure the pressure. To pass the test, zero leakage (i.e. zero pressure drop) shall be recorded;

- Upon successful completion of the test, gradually decrease the pressure to zero over a period of 3 hours;
- If the test fails, find the leak(s) and repair it before repeating the test until a successful result is achieved.

The hydrostatic test shall be regarded as satisfactory if no makeup water is required during the testing period and if no visible leaks are observed at joints, fitting valves, etc. if any hydrostatic test is unsatisfactory in any regard, the Contractor shall carry out all necessary remedial measures to approval and the test shall be repeated, all at his expense.

All visible leaks shall be made good and any pipe, special, or fitting found to be defective must be removed and replaced at the Contractor's expense. Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury."

Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury.

PSL 7.2.4.7 Remedial Measures

REPLACE THE SUB-CLAUSE 7.3.1c WITH THE FOLLOWING:

a) Should the maximum leakage limits as specified be exceeded, the Contractor shall determine the position and cause of the leaks and shall take remedial measures at his own expense and to the satisfaction of the Engineer to stop such leaks and ensure the specified degree of water tightness.

b) If during the contract period of maintenance, the number of leaks and other defects is considered by the Engineer to be more than could reasonably be expected from a well laid pipeline operating under normal conditions, he may order the Contractor to re-test parts or the whole of the pipeline at the Contractor's own expense and no claims for escalation in costs or for whatever other reasons the Contractor might consider to submit claims shall be considered, except where such re-tests are the result from damages caused to the pipeline by the Employer.

PSL-8 MEASUREMENT AND PAYMENT

PSL 8.2 Scheduled Items

PSL-8.2.1a HDPE pipes: 40 – 63mm dia

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE100 Class PN16 approved solid wall pipe in accordance with ISO 4427. All pipes 160mm and smaller shall be placed inside a HDPE pipe sleeve measured elsewhere.

Unit: (m)

The rate for the item shall amongst others include the supply of, proper inspection and selection of pipes, the jointing by means of butt welding, the placing of pipes in a prepared pipe trench and the successful testing including flushing and disinfecting the pipeline and commissioning of the pipe.

PSL-8.2.1b HDPE pipes: 75 – 315mm dia

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE100 Class PN12.5 approved solid wall pipe in accordance with ISO 4427. All pipes 160mm and smaller shall be placed inside a HDPE pipe sleeve measured elsewhere.

Unit: (m)

The rate for the item shall amongst others include the supply of, proper inspection and selection of pipes, the jointing by means of butt welding, the placing of pipes in a prepared pipe trench and the successful testing including flushing and disinfecting the pipeline and commissioning of the pipe.

PSL 8.2.1c HDPE Pipe sleeve

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, butt-weld join, lay, bed, test and commission the following HDPE type PE100 Class PN10 approved solid wall pipe sleeve in accordance with ISO 4427.

Unit: (m)

The rate for the item shall amongst others include the supply of, proper inspection and selection of pipes, the jointing by means of butt welding, the placing of pipes in a prepared pipe trench and the successful testing and commissioning of the pipe sleeve.

PSL 8.2.1d Random Destructive Testing

ADD THE FOLLOWING PAY ITEM:

Item: Extra over 6.1.1.0 - 6.1.3.0 for destructive testing of pipes (5%) Unit: Sum

The Contractor must allow for 5% destructive testing of all completed welds in the rates tendered. The rates tendered must allow for the replacing as well as the re-welding of any such pipes sections. Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSL 8.2.2 Fittings HDPE

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, butt-weld join, lay, bed, test and commission the following solid wall **moulded** HDPE, type PE100 Class PN16 pipe fittings in accordance with ISO 4427. All fittings for piping prepared

for butt welding on site to pipes or other fittings or stub and flange welded on in factory or in field. All stub and flanges measured as an extra over.

The rate for the item shall include the supply of, proper inspection and selection of fittings, the jointing by means of butt welding to the pipes, the placing and the successful testing and commissioning of HDPE butt welded pipe fittings.

PSL 8.2.11 Anchor/thrust blocks and pedestals

Item: Concrete Class 25/19 Thrust blocks

Unit: (m)

ADD THE FOLLOWING TO THE CLAUSE:

The rate for the installation of thrust blocks as per engineer's instruction shall consist of 25 MPa concrete placed in the position and configuration as per detail drawings. All thrust block sizes and position of placement shall be confirmed by the engineer prior to placing by the contractor. The engineer shall be notified 48hours prior to the intended excavation for a thrust block in order for the engineer to issue to the contractor a confirmed thrust block detail.

The rate for the thrust block shall include 25 MPa concrete to make up the entire volume of the thrust block. No other matter shall be included into the thrust block to take up volume. The rate shall further include the placing of reinforcing steel into the concrete at 50 kg steel per m^3 of concrete. The formwork and surface finishing to the thrust block shall also be included into the thrust block unit rate.

PSL 8.2.14 Manholes and Chambers

Note:
The scheduling of concrete chambers is scheduled under section PSGA.

ADD THE FOLLOWING ADDITIONAL SUB-ITEM:

(c) Preparation work for inspection of existing valves and meters

(1) Location and opening of manhole covers and pumping of chambers where necessary for Engineer's inspection

Unit: No

(2) Removal of manhole covers, refuse, rubble, soil, sludge and de-water chamber when required Unit: No

(3) Cleaning of valves/meters adjacent piping and valve chamber for chamber up to $10m^2$ Unit: No

(4) Cleaning of valves/meters adjacent piping and valve chamber for chamber exceeding $10m^2$ and up to $50m^2$ Unit: No

The tendered rates shall cover all the costs of labour, equipment and materials and all incidentals necessary to carry out the work specified.

The rate for item (c)(1) shall cover the costs to locate chambers of specific valves for the shut downs (as instructed by the Engineer), inclusive of limited excavation to expose buried manhole covers, opening of manhole covers and pumping as necessary for inspection of valve/meter chamber.

The tendered rate for item (c)(2) shall cover the cost of removing the manhole cover / refuse / rubble / soil / sludge and de-watering the chamber and disposing of the spoil material at an approved site found by the Contractor.

The tendered rate for items (c)(3) and (c)(4) shall include the cleaning of all pipes and fittings to remove all loose rust, dirt using water and brush as appropriate.

PSL-8.2.15 Preparation and Implementation of Pipeline Shut-down

ADD THE FOLLOWING SUBCLAUSE:

Item: Preparation and Implementation of Pipeline Shut-down

(a) Prepare and submit shut-down plan for approval by the Engineer — Unit: No

(b) Closure operation of valve and opening of hydrant/scour valve for shut-down purposes

(1) Valves of diameter 100mm up to 400mm — Unit: No
(2) Valves of diameter over 400mm up to 600mm — Unit: No

(3) Valves larger than 600mm diameter — Unit: No

(c) Mobilization, execution of the work and removal of plant, labour and materials for the execution of work required at a shut down operation — Unit: No

(d) Shut down operation extending beyond normal working hours due to Circumstances beyond the Contractor's control — Unit: No

(e) Standing time cost PRV site for shut-down and/or replacement operations due to delays not attributable to the Contractor — Unit: h

(f) Cutting of Existing pipe main/s (all material types) inclusive of repair and making good of corrosion protection.
(1) Diameter up to 200mm — Unit: No
(2) Diameter up to 400mm — Unit: No
(3) Diameter up to 600mm — Unit: No

(g) Supply and apply approved epoxy coating in Squish pack containers — Unit: No

The tendered rate for item (a) shall cover all the costs to prepare and submit a shutdown plan required.

The tendered rate for item (b) shall cover the cost of arrangement for a visit to the particular valve site with the relevant MLC and testing of the valve to affect closure of gate valves and opening of hydrants/scours.

Equipment shall be made available to listen to the valve and a pressure gauge shall be installed in a nearby location downstream of the valve to determine whether the valve is closing.

The Contractor shall take care not to open or close the valve quickly, a time period of at least 5 minutes must be allowed for each of these operations to prevent surge in the pipe mains. Refer to Clause 8.3.3.

The tendered rate for subitem (c) shall cover the cost of mobilization, execution of the work and removal of plant required at a shut-down operation including the installation of new pipes and fittings as specified, reconnection of the supply and compliance with all safety requirements.

The tendered rate for subitem (d) shall cover the cost to extend the shutting down operation for up to 15 hours after normal working hours, including the cost of extra plant requirements for work at night and additional cost for labour.

The tendered rate for subitem (e) shall cover the cost of standing time at PRV site (at normal rates), during complex valve shut-downs and/or replacement operations due to delays not attributable to the Contractor.

The tendered rate for subitem (f) shall be based on cut per pipe.

The tendered rate for subitem (g) shall be based on the number of squish packs applied.

PSL-8.2.16 Connect onto Existing Plumbing

ADD THE FOLLOWING SUBCLAUSE:

Item: Connect with existing plumbing of diameter: Unit: no

The tendered rate per connection shall cover the cost to establish the details of the existing pipe and other information required as well as any additional excavations required to provide working space over and above the necessary trench excavations and excavations previously done for locating existing pipelines, and the labour, equipment, tools, additional materials, incidentals and supervision necessary to cut into the existing pipe and to complete the connection. Pipes and pipe fittings will be measured elsewhere in the Bill of Quantities.

PSL-8.2.17 Pipe markers

ADD THE FOLLOWING SUBCLAUSE:

Item: Pipe markers as per DWG **N2281/W/3/014**. Unit: No

The tendered rate shall cover the cost for supply and installation of pipe markers as detailed on the drawings, including all excavations and backfilling as necessary. Pipe markers at bends, except where segmented paving occurs.

PSL-8.2.18 Testing of pipeline

ADD THE FOLLOWING SUBCLAUSE:

Item: Testing of existing pipeline Unit: Sum

The tendered sum shall cover the cost of testing a pipeline in accordance with Clause PSL7. The sum shall include all labour, equipment accessories and all incidents necessary for testing the pipeline. Excavations to open up defective pipe sections will not be paid for additionally and will be for the account of the Contractor.

PSL-8.2.19 Electrical Cable and Services Detection

ADD THE FOLLOWING SUBCLAUSE:

Item:

(a)	Detection of services and cables	Unit: Prov. Sum
(b)	Handling costs and charges on (a)	Unit : Percentage

The stated provisional sum shall cover the cost for the hiring of a specialist contractor to electronically detect underground services, electrical cables, telephone and communication lines as ordered by the Engineer.

PSL-8.2.20 Quality Assurance of HDPE Welded Joints

ADD THE FOLLOWING SUBCLAUSE:

Item:

(a)	Independent quality control testing of HDPE welded joints	Unit: Prov. Sum
(b)	Handling costs and charges on (a)	Unit : Percentage

The stated provisional sum shall cover the cost for the independent quality control of the welding operations, quality control systems and testing as ordered by the Engineer. The expenditure of this scheduled item is at the discretion of the Engineer and does not relieve the contractor of his obligation to do normal quality control as stipulated.

PSL-8.2.21 Water Meters

ADD THE FOLLOWING PAYMENT ITEM:

Item: Supply, install, test and commission the following combination bulk water meter and measuring device:

a) 200 mm dia.	Unit: No
b) 150 mm dia.	Unit: No
c) 100 mm dia.	Unit: No

The tendered rate shall allow for the supply, installation, testing and commissioning of the combination bulk water meters and measuring device in accordance with **PSL-3.13 WATER METER AND AUTOMATIC READING SPECIFICATION** including the remote sensing pads (two per compound meter) and all cables – 5 m with each register.

PSL-8.2.22 Water Meter Strainer

ADD THE FOLLOWING PAYMENT ITEM:

Item: Supply, install, test and commission the following water meter strainer:

a) 200 mm dia. Unit: No
b) 150 mm dia. Unit: No
c) 100 mm dia. Unit: No

The tendered rate shall allow for the supply, installation, testing and commissioning of the water meter strainer in accordance with PSL 3.14 STRAINERS.

PSL-8.2.23 Building Connections up to 63mmØ

ADD THE FOLLOWING PAYMENT ITEM:

Item: Building connection up to 63mmØ. Unit: No

Rate shall include all fittings according to detail **N/2281/W/3/004** but exclude the concrete valve box. The tendered rate shall allow for the supply, installation, testing and commissioning of the water meter assembly and all pipe fittings from the main line for pipe sizes up to 63mmØ as per reference drawing but excluding chamber and lid construction.

PSL-8.2.24 Building Connections from 90 - 125mmØ

ADD THE FOLLOWING PAYMENT ITEM:

Item: Building connection from 90 - 125mmØ Unit: No

Rate shall include all fittings according to detail **N/2281/W/3/004** but exclude the concrete valve box. The tendered rate shall allow for the supply, installation, testing and commissioning of the water meter assembly and all pipe fittings from the main line for pipe sizes from 90 - 125mmØ as per reference drawing but excluding chamber and lid construction.

PSL-8.2.25 Special Tests Requested by the Engineer

ADD THE FOLLOWING SUBCLAUSE:

a) Pipeline acceptance control and testing by an independent inspectorate ..... Unit: Prov. Sum
b) Percentage charges and profit on a) ..... Unit: Percentage

The stated provisional sum shall allow for conducting factory and on-site inspections and adjudication of test records that are relevant to the construction of the pipeline (e.g. welds, lining, coating and repairs, etc.) by an independent inspectorate appointed by the Engineer to act on his behalf.

PSLB BEDDING (SANS 1200 LB)

PSLB-1 SCOPE

This specification covers the preparation of bedding and bedding material for the installation of pipe services. This includes all water, sewer and stormwater pipes.

PSL-2 INTERPRETATIONS

PSL-2.1 Supporting Specifications

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

Reference is made to PW 344 Appropriate Development of Infrastructure on Dolomite Manual Department of Public Works. August 2017. **Specific attention is given to Annex P: Specification for HDPE Product Supply, Installation and Quality Control**. In the event that there is a direct contradiction between the aforementioned standard specification document and this document's specifications, the former shall take preference.

PSLB-3 MATERIALS

PSLB-3.3 Bedding

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

"Unless otherwise shown on the drawings or indicated in the Bill of Quantities or instructed by the Engineer, all rigid pipes shall be laid on a Class B bedding as specified in SANS 1200 LB.

Unless otherwise shown on the drawing or instructed by the Engineer, all flexible pipes shall be laid on a flexible pipe bedding as shown on drawing LB2(a) of SANS 1200 LB. The maximum aggregate size shall be limited to 6mm."

PSLB 3.1 Selected Granular Material (Sub-clause 3.1)

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

Granular materials shall be selected from trench and reservoir excavations. If the contractor elects not to apply selection of material from excavations, he shall provide suitable material from any other approved source at his own expense.

In the case of dolomite underlain land the use of non-cohesive singularly graded sand or crusher sand shall not be used for bedding, selected fill blanket and backfill of the trench to ensure that the bedding and fil blankets shall not allow free draining. The material used for bedding, selected fill blanket and backfill shall have a maximum particle size of 6mm and permeability that is lower than that of the surrounding in situ soil.

PSLB 3.3 Bedding

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

All HDPE pipes in the works shall be classed as “flexible” with welded joints and shall be bedded on Class B bedding as described in sub-clause 5.3 of SANS 1200 LB, unless otherwise specified or instructed by the Engineer.

PSLB-3.4 Selection

PSLB-3.4.1 Suitable material available from trench excavations

ADD THE FOLLOWING SUBCLAUSE:

Selected bedding material can be obtained from trench and other necessary excavations. If this is insufficient then extra bedding material can be imported from a borrow pit in the immediate vicinity subject to approval by the Engineer.

Bedding and blanket material shall after compaction be less impermeable than the in-situ soil.

PSLB 5 CONSTRUCTION

PSLB 5.1 General (Sub-Clause 5.1)

PSLB 5.1.3 Placing

Add to Sub-Clause 5.1.3.2:

In the case of dolomite underlain land joint holes shall not be filled with granular material, but only with material conforming with the requirements of PSL3.1.

PSLB 5.1.4 Compacting

Add:

In the case of dolomite underlain land, the required compaction shall be at least 93% of modified AASHTO maximum dry density at optimum moisture content or the density of the surrounding in situ soil, whichever is higher.

PSLB 5.5 Waterlogged Trench Bottoms

ADD SUB-CLAUSE 5.5 AS FOLLOWS:

a) Where trench bottoms are too soft and water logged to permit placement and compaction of bedding material in the normal manner, such trench bottoms shall be excavated to a depth of at least 300 mm below the underside of pipes and specials for the full width and length of the trench affected.

b) The full width and length of the trench bottom and at least 500 mm height of both sides of trench walls shall be covered by an unwoven approved geotextile, similar to Kaymat U24.

The full width and length of the trench shall thereupon be covered by a 300 mm thick layer of coarse gravel, coarse sand or 19 mm nominal size crushed stone, fully compacted within the confines of the geotextile to take the mass of the pipe filled with water and all loads on the pipe without settlement.

The free drainage layer shall be covered over the full width of the trench by a single layer of geotextile with the cloth on trench walls folded over and overlapping to completely seal off the free drainage layer against ingress of sand or fine soil particle.

Pipes shall be laid directly on the bed prepared as above and pipe bedding and selected backfill completed as specified.

PSLC CABLE DUCTS

PSLC1 MATERIALS

PSLC1.1 Alternative Materials for Pipes and Joints (Sub-Clause 3.5)

PSLC 3.5.1 HDPE Pipes

PSLC 3.5.1.1 General Requirements

HDPE pipes shall comply with the requirements of SANS 4427 / ISO 4427. Pipes shall preferably be joined by means of butt welding as per the requirements of SANS 4427. Where permitted in terms of the specification data, pipes may be joined together by means of suitable push fit, heated tool socket weld or electro fusion fittings recommended by the pipe manufacturer or butt fusion.

Supply lengths:

12m (minimum) (except: Up to 90mm diameter pipes should preferably be supplied in 100m rolls and 110mm diameter pipes in 50m rolls).

PSLC 3.5.1.2 Quality Assurance

It is the responsibility of the manufacturer/supplier to establish Quality Assurance by means of quality control procedures, which shall ensure that the product will meet the requirements of this specification. The manufacturer/supplier shall maintain a quality system that conforms to the requirements of SANS 9001 / ISO 9001:2015 or national equivalent. Applicable standard for manufacture of pipe shall be SANS 4427 / ISO 4427.

For all relevant requirements, certification or testing that may be necessary for quality assurance of raw material supply, manufacturing standards, equipment used in manufacturing or tests to ensure standards are met, refer to SANS 4427 / ISO 4427, SANS 10268, SANS 10269, SANS 10270, Sans 1655, SANS 1671, SANS 21138, SANS 674, ISO 9969 and relevant specifications.

The manufacture/supplier shall submit the following documents prior to delivery of material to site:

- Certificate of Registration – SANS 9001/SANS ISO 9001:2015 or National equivalent;
- Permit Certification – SANS 4427/SANS ISO 4427 for PE100;
- Quality Control Plan (QCP shall include Raw Material and Product Test Certificates);
- Last two audit reports according to SANS or National equivalent.

The manufacturer must unconditionally guarantee all HDPE products for a period of 100 years against any form of chemical decomposition or mechanical failure as a result of normal use in a 100-year lifecycle of expected pressures.

PSLC 3.5.1.3 General Product Requirements

PSLC 3.5.1.3.1 General

All finished HDPE products shall be free from cracks, voids, foreign inclusions and other defects, which would impair the overall performance. It shall be smooth walled on inside and outside and shall conform to the requirements (characteristics) outlined below.

PSLC 3.5.1.3.2 Characteristics of Raw Material

Raw Material: the HDPE manufacturing substance shall be 100% SANS ISO 4427 PE100 High Stress Crack Resistance certified virgin material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall have been tested in accordance with the ISO13479 Notched Pipe Test by an independent 3rd party laboratory and the time to failure shall have been ≥8,760 hours. HDPE structured wall manufacturing substance shall be 100% SANS ISO 4427 PE100 certified material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall be subjected and proved to be conforming to testing means and methods specified in SANS 4427.

Raw material declaration: the HDPE product manufacturer must declare in the tender documents the origin (supplier) of the raw material that will be used to manufacture the pipes for the contract. Raw material composition for pipes, fittings (e.g. stubs) and other elements (e.g. sheeting for benching) shall be PE 100 pre-compounded black.

Ash content: To be in accordance with SABS 533 part 1,2 and 3 clause 6.3 maximum not to exceed 0,1%(m/m).

PSLC 3.5.1.3.3 Technical Specification for Raw Material and Finished Product

Physical/Chemical Property	Standard	Value	Unit
Density	ISO 1183	0.949 – 0.960	g/cm³
Melt Flow Index (190°C/5kg)	ISO 1133	0.25 – 0,35	g/10min
Vicat Softening Point (5kg)	ISO 306	64 – 68	°C
Crystalline Melting Range	ISO 3146-85	130 – 135	°C
Viscosity Number	ISO 1628-3	390	cm³/g

Mechanical Property	Standard	Value	Unit
Shore D, Hardness	ISO 868	61	–
Elastic Modulus	ISO 527	900 – 1000	MPa
Tensile Yield	ISO 527 / ISO 6259	24	MPa
Ultimate Tensile Strength	ISO 527 / ISO 6259	35	MPa
Ultimate Elongation	ISO 527 / ISO 6259	>600	%
Flexural Stress (3.5% Deflection)	ISO 178	19	MPa
Thermal Stability (OIT @ 210°C)	ISO 10837	≥20	minutes

Carbon Black Content	ASTM D 1603 / ISO 6964	2.25 +/- 0.25	%

PSLC 3.5.1.3.4 Pipe Characteristics

Characteristics	**Applicable Standard**
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness @ any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

PSLC 3.5.2 HDPE Pipe Joints

All properties of pipe joints designed by the manufacturer must always exceed or be equivalent to the base parent pipe (i.e. joints shall not decrease the tensile strength properties of the overall pipeline).

PSLC 5.2 BEDDING AND COMPACTION OF BEDDING

PSLC 5.2.5 Bedding for Dolomite Underlain land

Bedding for ducts on dolomite underlain ground shall be according to the requirements of PSLB: Bedding (Pipes).

PSLC 5.3 DUCT LAYING

PSLC 5.3.5 Manholes, Chambers and Draw Pits on Dolomite Land

For dolomite underlain land manholes and inspection chambers shall preferably be manufactured from structured or solid wall HDPE or steel-reinforced spirally wound HDPE pipes and shall be watertight.

HDPE structured wall pipes shall be manufactured according to SANS 21138 or SANS 674 in terms of profile, pipe fittings and pipe endings, but with stainless steel stiffeners and 5mm minimum wall thickness. HDPE solid wall pipes shall be manufactured according to SANS 4427. Ring stiffness shall be tested according to ISO 9969 with:

i. 8,0kN/m² ring stiffness for all depths
ii. 4,0kN/m² ring stiffness for depths ≤1,5m where approved.

HDPE pipes to be extrusion welded to the manhole.
Benching shall consist of HDPE (PE100 to SANS 4427) flat sheet and pipe of minimum 12mm thickness.

PSLC 5.3.6 Covers for HDPE Manholes, Chambers and Draw Pits

For HDPE manholes, chambers and draw pits the manhole roof shall be an integral part of the chamber wall to form a watertight chamber. The cover (lid) shall be lockable (if required) and manufactured from a material that has no monitoring value (i.e. steel and cast iron lids are not acceptable).

PSLC 5.12 CONSTRUCTION OF HDPE PIPES, MANHOLES AND CHAMBERS

PSLC 5.12.1 HDPE Pipes, Manholes and Chambers

PSLC 5.12.1.1 Off-loading of Pipes and Fittings

The manufacturer's instructions regarding the off-loading of all HDPE pipes, fittings and manufactured items must be strictly adhered to. The specifications of such procedures must be in the site office of the contractor at all times. The Engineer must be provided with a copy of such procedures.

The Contractor must clear an area specifically for the purpose of off-loading HDPE products. This area must be free of rocks, boulders or any other foreign objects that may puncture, cut or scar the HDPE fittings, pipes and other manufactured items. The area must also be relatively level in one direction and the ponding of stormwater must not be permitted. The area must be kept in such condition for the duration of material being on site.

PSLC 5.12.1.2 Handling of Pipes on Site

The manufacturer's specification for the handling and transporting of material on site must be strictly adhered to. The Engineer shall write a specific instruction regarding this in the absence of such a manufacturer's instruction.

Under no circumstances shall the dragging of pipes on site be allowed. Dragging of the pipe will result in cuts, scratches and puncture marks that may result in weakening of the pipe.

Welded pipes shall be transported to the point of installation in accordance with the manufacturer's specification.

PSLC 5.12.1.3 Visual Inspection of Pipes for Defects

The Engineer will inspect all HDPE pipes for any visual defects such as cracks, deformation, wall thinning, etc. This in no means constitute approval of the pipes. It merely serves as an additional quality control feature to ensure that pipes with obvious defects are rejected from the beginning.

Pipes found to have such defects, must also be brought under the attention of the supplier in writing. The suppliers must respond in writing. Copies of such cases must be forwarded to the Engineer. In the event of not resolving such cases, the matter must be referred to the Technical Committee of the South African Plastic Pipe Manufacturing Association (SAPPMA) for comments in terms of SANS ISO 4427: 1996.

PSLC 5.12.1.4 Pipe Marking

All HDPE Pipes shall be indelibly marked at 1-meter intervals with the following details:

Reference Item	Mark Printed
Trade name	Manufacturer/Supplier Name
Specification	ISO 4427 / SANS 4427
Pipe OD	e.g. 160
Pipe OD tolerance	Grade B
Wall thickness	e.g. 7.7
Nominal pressure	e.g. PN 10
Material designation	PE 100
Batch No.	Manufacturer/Supplier Trace ability
Application	SEWER or WATER or STORMWATER or "SLEEVE-WATER" or any other application

PSLC 5.12.1.5 Inspection of Installed HDPE Pipes by Engineer

The Engineer shall be notified to inspect all HDPE pipes and fittings 24 hours prior to backfilling of trenches. All pipes with cut, scratch, puncture marks or signs of deforming will be rejected from a quality control perspective. In such cases, the Contractor must submit a certificate of approval from the pipe supplier. This document must clearly state that the supplier approved the integrity of the pipes, irrespective of the noted damages. If such an approval certificate is not supplied, the Engineer reserves the right to reject such parts of the installation as he/she sees fit.

Any dispute in this regard must be referred to the Department of Public Works Project Manager.

PSLC 5.12.2 Cover

For HDPE pipes the minimum soil cover shall be:

Average : 750mm
Outside traffic areas : 600mm
Inside traffic areas : 1000mm

Where these minimum thicknesses cannot be met, appropriately designed concrete slabs shall be used as protection or if imposed loads necessitates protection.

PSLC 5.12.3 Jointing Methods

PSLC 5.12.3.1 Welding of HDPE

The welding of HDPE using the heated tool butt welding and heated tool socket welding processes shall be undertaken in accordance with the requirements of SANS 10268-1 using equipment that satisfies the requirements of SANS 1671-1.

The welding of HDPE pipes by means of electro fusion shall be in accordance with the requirements of SANS 10268-2. The acceptability of the weld shall be assessed in accordance with the assessment table contains in SANS 10268-10.

Welders shall, where specified, be tested and certified in accordance with the requirements of SANS 10269 and be in possession of a valid test certificate. Welders shall be trained by a registered Mersita training facility with a minimum NQF 3 qualification.

Before use, metal heating plates shall be cleaned of all traces of polyethylene remaining from previous operations to avoid inclusion of oxidized polyethylene in the weld.

The end of all pipes jointed by means of an electrofusion fitting, shall be prepared prior to jointing by scraping off any surface oxide and being thoroughly cleaned with a suitable cleaner. Angle grinders shall not be used for preparing surfaces.

The two elements that are to be jointed in the butt-welding process, shall not be under tension or lateral stress during the welding operation.

PSLC-7 TESTING

PSLC-7.1 Tests and Acceptance/Rejection Criteria

PSLC-7.2.1 Acceptance tests

REPLACE THE EXISTING SUB-CLAUSE WITH:

The equivalent testing Sub-Clauses 7.1 to 7.1.8 of SANS 1200 LD (Sewers) shall apply to all HDPE pipe sleeves. Only air tests will be required for all pipe diameters. Refer to PSLC 7.4.6 below.

PSLC 7.4.1 General

Testing as contained in ISO 4427 / SANS 4427 shall apply. Tests shall also be conducted ad-hoc by a registered and authorised testing body as approved by the Department of Public Works.

PSLC 7.4.2 Raw Material Acceptance Tests

The material used for the production of the pipes and fittings or structures, shall be high-density polyethylene (HDPE) PE 100. To confirm the quality of this product, the following test shall be performed.

- Density
- Melt Flow Index
- Carbon Black content
- Carbon Black distribution

PSLC 7.4.3 Testing of HDPE Welding

For weld joint evaluation, water pipes are classified as Assessment Class 1, according to SANS 10268-10. Tests on welds shall be performed according to the requirements of SANS 6269 and all pipe system weld factors shall be ≥1.

The Contractor shall submit to the Engineer the results of tensile, bend and peel tests performed according to SANS 6269 by the manufacturer on each batch of HDPE pipe delivered to site.

The Engineer shall visually inspect all welds on site, including welding rod property evaluation as required. The Engineer shall have 1% of all welds performed removed (sampled) and tested for tensile strength according to SANS 6269 by an approved independent and accredited testing facility.

PSLC 7.4.4 Pressure Testing of HDPE Pipes in Laboratory

The Contractor shall provide for quick pressure testing of all pipe sizes delivered to site with at least one test per 250m of duct pipe.

The pressure test involves:

- Selection of 3 samples, at random by the independent test laboratory, of pipes having a minimum length of 1m with all relevant pipe markings on and free of scratches and defects;
- Conditioning of the pipe or fitting in water for 12 hours at 20°C;
- Standard pressure test procedures according to ISO 4427;
- Failure test: apply internal pressure at 5bar/min until failure – PE 100 pipes must reach a pressure of at least twice the Minimum Required Strength (MRS) as per ISO 4427 / SANS 4427;
- Upon failure to pass the test procedure as described above, standard pressure test procedures as per SABS ISO 4427 must be applied.

PSLC 7.4.5 Permissible Leakage Rates

The permissible leakage rate for HDPE pipes, manholes and inspection chambers shall be zero.

PSLC 7.4.6 Testing of HDPE pipe sections

All completed ducts shall be satisfactorily tested and no payment in respect of pipe laying or the supply of pipes and fittings on any section of pipeline shall be made until such tests have been completed successfully.

Air tests shall be carried out on approved completed pipe sections with suitable length as approved by the Engineer.

The Contractor shall be responsible for arranging all aspects of air testing and for the supply of all equipment, materials and labour required.

The maximum air test pressure for field testing shall be 100kPa.
The air test procedure shall be as follows:

- Isolate the section of pipe to be tested by inserting airtight packers, one of which is connected to the air testing machine;
- Gradually raise the gauge pressure in the pipe in 10kPa steps, with a 2-minute stabilisation period between steps, to 100kPa and ensure that there is no air leakage at the packers;
- Switch off the machine and keep the pressure in the pipe for 1 hour. After 1 hour, the gauge reading shall remain constant to indicate zero air leakage;
- If the gauge reading reduces by more than 1% over 1 hour, the pipe shall be deemed to have failed the air test and the pipe test section rejected;
- Upon completion of the air test, gradually decrease the pressure to zero over a period of 20 minutes;
- After rejection of a pipe section that has failed the air test, the Contractor may apply a water test to locate the source of failure, rectify the pipe section and re-apply the air test. The pipe section will be accepted if zero leakage is achieved.

Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury.

The water test procedure shall be as follows:

- Fill the pipe section with water to such a depth that every portion of the pipeline is subjected to a pressure of at least 100kPa.;
- After an initial period of 30 minutes, accurately measure and mark the water level and keep filled for 1 hour;
- Check (or measure) the water level after 1 hour to record the water level;
- The test is successful if the recorded water levels are the same to indicate zero leakage.

PSLC-7.4.7 Water tightness of manholes

Manholes shall be tested for water tightness.

A water test shall be applied for the detection of leakage of manholes. The test shall be applied to manholes in succession, commencing at the upper end of the sewer network. The manhole shall be closed with water tight expanding plugs and the chamber filled with water to the brim. The water shall remain in the manhole for a period of 30 minutes and thereafter shall show no measurable drop for a further period of 48 hours. After the test period, the water shall be released down the sewer pipe.

PSLC-8 MEASUREMENT AND PAYMENT

PSLC-8.1 General

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

“A length of cable duct will be included in a certificate measurement for payment only when such length has been completely backfilled, the manhole on both ends completed and the surplus material removed.” Payment for the manholes will be made only after covers and frames have been installed and the surface of the roadway or sidewalk reinstated or refilled and completed and surplus material removed.

PSLC-8.2 Scheduled Items

PSLC-8.2.5 DUCTS - HDPE

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, lay, butt-weld, joint, bed and prove duct complete as per Type PE100, PN10 pipes to SANS ISO 4427/SANS 4427, in the following diameters:

a) 110 mm pipe assembly (x 2 No. ducts) Unit: m
b) 110 mm pipe assembly (x 4 No. ducts) Unit: m
c) 110 mm pipe assembly (x 6 No. ducts) Unit: m

The tendered rates shall also cover the cost of storing on site, handling, inspecting and cutting of pipes to suit.

PSLC 8.2.6 Random Destructive Testing

ADD THE FOLLOWING PAY ITEM:

Item: Extra over 4.1.1.0 for destructive testing of pipes (5%) Unit: Sum

The Contractor must allow for 5% destructive testing of all completed welds in the rates tendered. The rates tendered must allow for the replacing as well as the re-welding of any such pipes sections. Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSLC-8.2.7 Testing of Duct

ADD THE FOLLOWING SUBCLAUSE:

Item: Testing of duct Unit: Sum

The tendered sum shall cover the cost of testing a pipe / duct in accordance with Sub-Clauses PSLC 7.4.6. The sum shall include all labour, equipment accessories and all incidents necessary for testing the pipe sleeve. Excavations to open up defective pipe sections will not be paid for additionally and will be for the account of the Contractor.

PSLC-8.2.8 HDPE Drawpits / Manholes

ADD THE FOLLOWING SUBCLAUSE:

Item: 1000 -1500 mm Unit: No

Construct manhole complete from a single length 1000mm diameter HDPE PE100 SN8 pipe shaft (minimum 8kN/m² ring stiffness as per ISO 9969 and min 5mm wall thickness), with inclusion of factory

fitted 15mm base plate. The manhole must be factory fitted with steps in a staggered pattern and spaced at 250 mm centre to centre and flexible water tight rubber socket joints. Cover slab and lid to be specified as per drawing and measured elsewhere. Including all excavations. Foundation to be 250 mm thick 25 MPa/19mm concrete filled to fully support benching, bottom rim and to extend 300 mm beyond bottom rim of manhole and cast at 300mm wide, 200mm thick 25 MPa/19 mm concrete collar at top of manhole to provide a foundation for the cover slab. For depths:

Should steel reinforced HDPE pipes be used, the mild steel reinforcing must be replaced with Stainless Steel Grade 430 (minimum) in accordance with the manufacturer's standards and to the approval of the Engineer.

PSLC-8.2.9 Electrical cable and services detection

ADD THE FOLLOWING SUBCLAUSE:

Item:

(a) Detection of services and cables — Unit: Prov. Sum

(b) Handling costs and charges on (a) — Unit : Percentage

The stated provisional sum shall cover the cost for the hiring of a specialist contractor to electronically detect underground services, electrical cables, telephone and communication lines as ordered by the Engineer.

PSLC 8.2.10 Quality assurance of HDPE welded joints

(a) Independent quality control testing of HDPE welded joints .....Unit : Prov Sum
(b) Percentage charges and profit on (a) ..... ….Unit : Percentage

The stated provisional sum shall cover the cost for the independent quality control of the welding operations, quality control systems and testing as ordered by the Engineer. The expenditure of this scheduled item is at the discretion of the Engineer and does not relieve the contractor of his obligation to do normal quality control as stipulated.

PSLC 8.2.11 Special Tests Requested by the Engineer

a) Pipeline acceptance control and testing by an independent inspectorate.....Unit: Prov. Sum

b) Percentage charges and profit on a).....Unit: Percentage

The stated provisional sum shall allow for conducting factory and on-site inspections and adjudication of test records that are relevant to the construction of the pipeline (e.g. welds, lining, coating and repairs, etc.) by an independent inspectorate appointed by the Engineer to act on his behalf.

PSLD SEWERS

PSLD-2 INTERPRETATIONS

PSLD-2.1 Supporting Specifications

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

Reference is made to PW 344 Appropriate Development of Infrastructure on Dolomite Manual Department of Public Works. August 2017. **Specific attention is given to Annex P: Specification for HDPE Product Supply, Installation and Quality Control**. In the event that there is a direct contradiction between the aforementioned standard specification document and this document's specifications, the former shall take preference.

PSLD-2.4 Abbreviations

ADD THE FOLLOWING:

"HDPE: High Density Polyethylene"

PSLD-3 MATERIALS

PSLD-3.1 Pipes, Fittings and Pipe Joints

REPLACE THIS SUBCLAUSE WITH THE FOLLOWING:

"All sewer pipes must be solid wall HDPE sewer piping PE100, PN10 according to SANS ISO 4427 or as indicated on the drawings. All joints shall be butt-welded or Electrofusion-welded (where agreed)." The HDPE piping shall be supplied in maximum possible lengths permitted by diameter and handling constraints. The handling of the piping shall be in accordance with the manufacturer's standards and the approval of the Engineer.

Supply lengths: 12m (minimum)

PSLD-3.2 Alternative Materials for Pipes, Fittings and Joints

PSLD 3.2.1 HDPE Pipes

PSLD 3.2.1.1 General Requirements

HDPE pipes shall comply with the requirements of SANS 4427 / ISO 4427. Pipes shall preferably be joined by means of butt welding as per the requirements of SANS 4427. Where permitted in terms of the specification data, pipes may be joined together by means of suitable push fit, heated tool socket weld or electro fusion fittings recommended by the pipe manufacturer or butt fusion.

PSLD 3.2.1.2 Quality Assurance

It is the responsibility of the manufacturer/supplier to establish Quality Assurance by means of quality control procedures, which shall ensure that the product will meet the requirements of this specification. The manufacturer/supplier shall maintain a quality system that conforms to the requirements of SANS 9001 / ISO 9001:2015 or national equivalent. Applicable standard for manufacture of pipe shall be SANS 4427 / ISO 4427.

For all relevant requirements, certification or testing that may be necessary for quality assurance of raw material supply, manufacturing standards, equipment used in manufacturing or tests to ensure standards are met, refer to SANS 4427 / ISO 4427, SANS 10268, SANS 10269, SANS 10270, Sans 1655, SANS 1671, SANS 21138, SANS 674, ISO 9969 and relevant specifications.

The manufacture/supplier shall submit the following documents prior to delivery of material to site:

- Certificate of Registration – SANS 9001/SANS ISO 9001:2015 or National equivalent;
- Permit Certification – SANS 4427/SANS ISO 4427 for PE100;
- Quality Control Plan (QCP shall include Raw Material and Product Test Certificates);
- Last two audit reports according to SANS or National equivalent.

The manufacturer must unconditionally guarantee all HDPE products for a period of 100 years against any form of chemical decomposition or mechanical failure as a result of normal use in a 100-year lifecycle of expected pressures.

PSLD 3.2.1.3 General Product Requirements

PSLD 3.2.1.3.1 General

All finished HDPE products shall be free from cracks, voids, foreign inclusions and other defects, which would impair the overall performance. It shall be smooth walled on inside and outside and shall conform to the requirements (characteristics) outlined below.

PSLD 3.2.1.3.2 Characteristics of Raw Material

Raw Material: the HDPE manufacturing substance shall be 100% SANS ISO 4427 PE100 High Stress Crack Resistance certified virgin material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall have been tested in accordance with the ISO13479 Notched Pipe Test by an independent 3rd party laboratory and the time to failure shall have been ≥8,760 hours. HDPE structured wall manufacturing substance shall be 100% SANS ISO 4427 PE100 certified material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall be subjected and proved to be conforming to testing means and methods specified in SANS 4427.

Raw material declaration: the HDPE product manufacturer must declare in the tender documents the origin (supplier) of the raw material that will be used to manufacture the pipes for the contract. Raw material composition for pipes, fittings (e.g. stubs) and other elements (e.g. sheeting for benching) shall be PE 100 pre-compounded black.

Ash content: To be in accordance with SABS 533 part 1,2 and 3 clause 6.3 maximum not to exceed 0,1%(m/m).

PSLD 3.2.1.3.3 Technical Specification for Raw Material and Finished Product

Physical/Chemical Property	Standard	Value	Unit
Density	ISO 1183	0.949 – 0.960	g/cm³
Melt Flow Index (190°C/5kg)	ISO 1133	0.25 – 0,35	g/10min
Vicat Softening Point (5kg)	ISO 306	64 – 68	°C
Crystalline Melting Range	ISO 3146-85	130 – 135	°C
Viscosity Number	ISO 1628-3	390	cm³/g

Mechanical Property	Standard	Value	Unit
Shore D, Hardness	ISO 868	61	–
Elastic Modulus	ISO 527	900 – 1000	MPa
Tensile Yield	ISO 527 / ISO 6259	24	MPa
Ultimate Tensile Strength	ISO 527 / ISO 6259	35	MPa
Ultimate Elongation	ISO 527 / ISO 6259	>600	%
Flexural Stress (3.5% Deflection)	ISO 178	19	MPa
Thermal Stability (OIT @ 210°C)	ISO 10837	≥20	minutes
Carbon Black Content	ASTM D 1603 / ISO 6964	2.25 - 0.25	%

PSLD 3.2.1.3.4 Pipe Characteristics

Characteristics	Applicable Standard
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness @ any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

PSLD 3.2.2. HDPE Fittings and Specials

All HDPE fittings and specials shall be moulded from pipe complying with the requirements given in PSLD 3.2.1.1. In addition, all pipe fittings and specials shall be free of weld spatter and all sharp corners and edges shall be chamfered smooth.

Welders who are competent in terms of the relevant procedure approval test shall carry out all welding and proof of such competency may be required by the Engineer.

PSLD 3.2.3 Steel Mesh Reinforced PE Pipes

Steel mesh reinforced polyethylene (PE) pipes shall comply with the requirements of SANS 370 and have a PN 16 nominal pressure rating for pipes with a diameter of up to 160mm. Such pipes shall be joined by means of either an electrofusion coupling or flanged fitting complying with the requirements of SANS 371.

PSLD 3.2.4 HDPE Pipe Joints

All properties of pipe joints designed by the manufacturer must always exceed or be equivalent to the base parent pipe (i.e. joints shall not decrease the tensile strength properties of the overall pipeline).

Jointing of HDPE solid wall piping shall be by means of welding as specified in SANS 10268-1 (Heated tool welding). All welding shall be carried out by the manufacturer or through an approved Sub-Contractor with a proven track record for welding of HDPE pipes and all completed welds must be documented. **Weld records include pipe section info, date, time, welding operator, GPS coordinate and photograph of weld.** The control of welding procedure is solely the responsibility of the Contractor and adequate provision must be made in the priced rates to accommodate the quality control.

PSLD-3.5 Manholes, Chambers, Etc.

REPLACE THIS SUBCLAUSE WITH THE FOLLOWING:

Unless detailed to the contrary on the drawings, or scheduled in the Schedule of Quantities or otherwise instructed by the Engineer, all manholes shall be prefabricated in a factory or controlled environment from structured wall or other approved polyethylene pipe sections as detailed on the typical drawings for sewer manholes. All polyethylene pipes shall comply with the applicable requirements of SANS ISO 4427 and the manufacturer must have a minimum ISO 9001:2015 accreditation.

All sewer manholes must be prefabricated from a single length 1000mm Ø HDPE PE100 SN8 pipe shaft (minimum 8kN/m^2 ring stiffness as per ISO 9969) forming the chamber wall (min 5mm wall thickness), with minimum 300mm collars to allow butt-welding of the in- and outlet sewer pipes. The manhole must be factory fitted with steps in a staggered pattern and spaced at 250mm centre to centre and flexible water tight rubber socket joints. The manhole must be completely watertight and withstand the hydrostatic uplift force when empty and the level of the water table equal to the top of the manhole.

Concrete encasement of the bottom section of the manhole may only take place after the prescribed air/hydraulic test has been completed.

Should steel reinforced HDPE pipes be used, the mild steel reinforcing must be replaced with Stainless Steel Grade 430 (minimum) in accordance with the manufacturer's standards and to the approval of the Engineer.

PSLD 3.5.7 Step Irons

Add "or HDPE, as appropriate" at end of sub-clause.

PSLD 3.5.9 Manholes, Chambers and Draw Pits on Dolomite Land

For dolomite underlain land manholes and inspection chambers shall preferably be manufactured from structured or solid wall HDPE or steel-reinforced spirally wound HDPE pipes and shall be watertight.

HDPE structured wall pipes shall be manufactured according to SANS 21138 or SANS 674 in terms of profile, pipe fittings and pipe endings, but with stainless steel stiffeners and 5mm minimum wall thickness. HDPE solid wall pipes shall be manufactured according to SANS 4427. Ring stiffness shall be tested according to ISO 9969 with:

i. 8,0kN/m² ring stiffness for all depths
ii. 4,0kN/m² ring stiffness for depths ≤1,5m where approved.

HDPE pipes to be extrusion welded to the manhole.
Benching shall consist of HDPE (PE100 to SANS 4427) flat sheet and pipe of minimum 12mm thickness.

PSLD 3.5.10 Covers for HDPE Manholes, Chambers and Surface Boxes

For HDPE manholes and inspection chambers, the manhole roof shall be an integral part of the chamber wall to form a watertight chamber. The cover (lid) shall be lockable and manufactured from a material that has no monitory value (i.e. steel and CI lids are not acceptable).

PSLD-5 CONSTRUCTION

PSLD-5.1 Trench Bottom

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

“Pipe laying may not commence in trenches prior to the approval by the Engineer.

When the total length of completed sewer which has not yet been commissioned exceeds 100m, no further pipe laying may be done without the Engineer’s approval.”

PSLD-5.2 Laying and Bedding

PSLD-5.2.3 Method

ADD THE FOLLOWING SUBITEM:

(d) “Pipes having a slope of greater than 1:6 shall be encased in 20/13 MPa concrete”

All pipes shall be laid true to line and level using Laser equipment with trained Operators.

PSLD-5.6 Manholes, Inspection Chambers, Etc.

PSLD-5.6.1 General

ADD THE FOLLOWING SUB ITEM:

(g) Cover slab and lid to be heavy duty type 1a SANS 558 cast iron cover lid on concrete slab of type 1A units. Foundation to be 250 mm 25/19 concrete filled to fully support benching, bottom rim and extend 300 mm beyond bottom rim of main shaft.

Cut away 200mm of outer-rim of top manhole and cast at 300 mm wide, 200mm thick 25/19 concrete Collar at top of manhole to provide a foundation for the covers bib.

PSLD-5.6.2 Benching

ADD THE FOLLOWING SUB ITEM:

PSLD-5.6.2.4 Benching and manhole floors shall be an integral part of the HDPE prefabricated manhole.

PSLD-5.6.7 Reconstruct Existing Manhole Benching

ADD THE FOLLOWING SUBCLAUSE:

Rebuild existing manhole benching by breaking out existing pipes, channels, fittings and benching, replace with new pipes, channels, fittings as required to promote the flow direction. Reconstruct the benching in accordance with Sub-clause 5.6.2. including reconnecting of all connection pipework. The type of connection (butt-weld or electrofusion) must be confirmed prior to commencement of the works.

PSLD-5.7 Concrete Casing to Pipes

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

“Where indicated or directed, pipes shall be encased in 20 MPa concrete. Sewer pipes passing under an existing pipe shall be totally encased for 1m on either side of such pipe.”

Measurement shall be based on the nominal trench dimensions as shown on the drawings. No additional payment will be made for overbreak, over-excavation or removal of loose material.”

PSLD 5.11 HDPE Pipes, Manholes and Chambers

PSLD 5.11.1 HDPE Product Supply, Installation and Quality Control

PSLD 5.11.1.1 Off-loading of Pipes and Fittings

The manufacturer’s instructions regarding the off-loading of all HDPE pipes, fittings and manufactured items must be strictly adhered to. The specifications of such procedures must be in the site office of the contractor at all times. The Engineer must be provided with a copy of such procedures. The Contractor must clear an area specifically for the purpose of off-loading HDPE products. This area must be free of rocks, boulders or any other foreign objects that may puncture, cut or scar the HDPE fittings, pipes and other manufactured items. The area must also be relatively level in one direction and the ponding of stormwater must not be permitted. The area must be kept in such condition for the duration of material being on site.

PSLD 5.11.1.2 Handling of Pipes on Site

The manufacturer's specification for the handling and transporting of material on site must be strictly adhered to. The Engineer shall write a specific instruction regarding this in the absence of such a manufacturer's instruction.

Under no circumstances shall the dragging of pipes on site be allowed. Dragging of the pipe will result in cuts, scratches and puncture marks that may result in weakening of the pipe.

Welded pipes shall be transported to the point of installation in accordance with the manufacturer's specification.

PSLD 5.11.1.3 Visual Inspection of Pipes for Defects

The Engineer will inspect all HDPE pipes for any visual defects such as cracks, deformation, wall thinning, etc. This in no means constitute approval of the pipes. It merely serves as an additional quality control feature to ensure that pipes with obvious defects are rejected from the beginning.

Pipes found to have such defects, must also be brought under the attention of the supplier in writing. The suppliers must respond in writing. Copies of such cases must be forwarded to the Engineer. In the event of not resolving such cases, the matter must be referred to the Technical Committee of the South African Plastic Pipe Manufacturing Association (SAPPMA) for comments in terms of SANS ISO 4427: 1996.

PSLD 5.11.1.4 Pipe Marking

All HDPE Pipes shall be indelibly marked at 1-meter intervals with the following details:

Reference Item	**Mark Printed**
Trade name	Manufacturer/Supplier Name
Specification	ISO 4427 / SANS 4427
Pipe OD	e.g. 160
Pipe OD tolerance	Grade B
Wall thickness	e.g. 7.7
Nominal pressure	e.g. PN 10
Material designation	PE 100
Batch No.	Manufacturer/Supplier Trace ability
Application	SEWER or WATER or STORMWATER or "SLEEVE-WATER" or any other application

PSLD 5.11.1.5 Inspection of Installed HDPE Pipes by Engineer

The Engineer shall be notified to inspect all HDPE pipes and fittings 24 hours prior to backfilling of trenches. All pipes with cut, scratch, puncture marks or signs of deforming will be rejected from a quality control perspective. In such cases, the Contractor must submit a certificate of approval from the pipe supplier. This document must clearly state that the supplier approved the integrity of the pipes, irrespective of the noted damages. If such an approval certificate is not supplied, the Engineer reserves the right to reject such parts of the installation as he/she sees fit.

Any dispute in this regard must be referred to the Department of Public Works Project Manager.

PSLD 5.11.1.6 Temporary Connections

All temporary connections to water systems shall not be backfilled unless with the express written instruction of the Engineer. The installation shall, as a rule, be left open and barricaded as per the contractual standards until the permanent connections are made.

PSLD 5.11.2 Cover

For HDPE pipes the minimum soil cover shall be:

Average	:	750mm
Outside traffic areas	:	600mm
Inside traffic areas	:	1000mm

Where these minimum thicknesses cannot be met, appropriately designed concrete slabs shall be used as protection or if imposed loads necessitate protection.

PSLD 5.11.3 Jointing Methods

PSLD 5.11.3.1 Welding of HDPE

The welding of HDPE using the heated tool butt welding and heated tool socket welding processes shall be undertaken in accordance with the requirements of SANS 10268-1 using equipment that satisfies the requirements of SANS 1671-1.

The welding of HDPE pipes by means of electro fusion shall be in accordance with the requirements of SANS 10268-2. The acceptability of the weld shall be assessed in accordance with the assessment table contains in SANS 10268-10.

Welders shall, where specified, be tested and certified in accordance with the requirements of SANS 10269 and be in possession of a valid test certificate. Welders shall be trained by a registered Mersita training facility with a minimum NQF 3 qualification.

Before use, metal heating plates shall be cleaned of all traces of polyethylene remaining from previous operations to avoid inclusion of oxidized polyethylene in the weld.

The end of all pipes jointed by means of an electrofusion fitting, shall be prepared prior to jointing by scraping off any surface oxide and being thoroughly cleaned with a suitable cleaner. Angle grinders shall not be used for preparing surfaces.

The two elements that are to be jointed in the butt-welding process, shall not be under tension or lateral stress during the welding operation.

PSLD 5.11.3.2 Removal of HDPE Pipe Shavings

During the preparation phase of welding surfaces, all care must be taken to ensure that pipe shavings are not left behind in pipes.

The entire system should be monitored for blockages after installation and the Engineer shall introduce measures to ensure that the rectification of blockages remains the responsibility of the Contractor for the duration of the contract up to final delivery.

PSLD 5.11.3.3 Removal of Welding Beads from HDPE Pipes

After butt-welding of HDPE sewer pipes, the internal welding bead must be removed from all solid wall pipes (all diameters).

The engineer must inspect the contractor's equipment for this work and instruct the contractor to weld test pieces of the various pipe sizes to be used on site and remove the beads. These examples of the removed beads, as well as the welded pipe sections, must be kept on site for the duration of the project.

The removed beads must show no signs of cracking (cut too cold) or extreme deformation (cut too hot).
All welding beads removed from the installed pipes shall be marked sequentially with the same number as the weld. All welded joints must be sequentially numbered with white weatherproof paint. These weld positions must be transferred to an as-built drawing.

The contractor must store the removed welding beads to the end of the retention period.

It is important when removing weld beads that:

a) The cut direction is the same as the liquid flow direction;
b) The bead cutter must be fitted with equipment to extract the bead after cutting;
c) The equipment must be able to cut the bead in one operation. Multiple cuts may lead to uneven or sharp burr ends on the pipe surface.

PSLD 5.11.3.4 Rising Mains

HDPE pipes used as rising mains shall be similar to the HDPE pipes as specified in PSLD3.1.1, but the pressure class shall be as required by the specific design.

PSLD-5.12 Maintain Sewage Flow (Additional Sub-clause)

The contractor will be required to maintain the sewage flow during the rerouting and replacement of sewers. The contractor will have to provide pumping equipment, pipes, fittings, etc. as will be required to maintain the flow in the sewer when replacing sewers, rebuilding existing manholes and connecting into new or existing sewers. The pumping or other equipment, pipes, fittings, etc. shall be available to maintain the flow for as long as may be required.

PSLD-7 TESTING

PSLD-7.2 Tests and Acceptance/Rejection Criteria

PSLD-7.2.1 General

Testing as contained in ISO 4427 / SANS 4427 shall apply. Tests shall also be conducted ad-hoc by a registered and authorised testing body as approved by the Department of Public Works.

PSLD- 7.2.2 Raw Material Acceptance Tests

The material used for the production of the pipes and fittings or structures, shall be high-density polyethylene (HDPE) PE 100. To confirm the quality of this product, the following test shall be performed.

- Density
- Melt Flow Index
- Carbon Black content
- Carbon Black distribution

PSLD-7.2.3 Testing of HDPE welding

For weld joint evaluation, water pipes are classified as Assessment Class 1, according to SANS 10268-10. Tests on welds shall be performed according to the requirements of SANS 6269 and all pipe system weld factors shall be ≥1.

The Contractor shall submit to the Engineer the results of tensile, bend and peel tests performed according to SANS 6269 by the manufacturer on each batch of HDPE pipe delivered to site.

The Engineer shall visually inspect all welds on site, including welding rod property evaluation as required. The Engineer shall have 1% of all welds performed removed (sampled) and tested for tensile strength according to SANS 6269 by an approved independent and accredited testing facility.

PSLD-7.2.4 Pressure testing of HDPE pipes in Laboratory

The Contractor shall provide for quick pressure testing of all pipe sizes delivered to site with at least one test per 250m of sewer pipe.

The pressure test involves:

- Selection of 3 samples, at random by the independent test laboratory, of pipes having a minimum length of 1m with all relevant pipe markings on and free of scratches and defects;
- Conditioning of the pipe or fitting in water for 12 hours at 20°C;
- Standard pressure test procedures according to ISO 4427;
- Failure test: apply internal pressure at 5bar/min until failure – PE 100 pipes must reach a pressure of at least twice the Minimum Required Strength (MRS) as per ISO 4427 / SANS 4427;
- Upon failure to pass the test procedure as described above, standard pressure test procedures as per SABS ISO 4427 must be applied.

PSLD-7.2.5 Permissible Leakage Rates

The permissible leakage rate for HDPE pipes, manholes and inspection chambers shall be zero.

PSLD-7.2.6 Testing of HDPE pipe sections

All completed sewer lines shall be satisfactorily tested and no payment in respect of pipe laying or the supply of pipes and fittings on any section of pipeline shall be made until such tests have been completed successfully.

Air tests shall be carried out on approved completed pipe sections with suitable length as approved by the Engineer.

The Contractor shall be responsible for arranging all aspects of air testing and for the supply of all equipment, materials and labour required.

The maximum air test pressure for field testing shall be 100kPa.

The air test procedure shall be as follows:

- Isolate the section of pipe to be tested by inserting airtight packers, one of which is connected to the air testing machine;
- Gradually raise the gauge pressure in the pipe in 10kPa steps, with a 2 minute stabilisation period between steps, to 100kPa and ensure that there is no air leakage at the packers;
- Switch off the machine and keep the pressure in the pipe for 1 hour. After 1 hour, the gauge reading shall remain constant to indicate zero air leakage;
- If the gauge reading reduces by more than 1% over 1 hour, the pipe shall be deemed to have failed the air test and the pipe test section rejected;
- Upon completion of the air test, gradually decrease the pressure to zero over a period of 20 minutes;
- After rejection of a pipe section that has failed the air test, the Contractor may apply a water test to locate the source of failure, rectify the pipe section and re-apply the air test. The pipe section will be accepted if zero leakage is achieved.

Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury.

The water test procedure shall be as follows:

- Fill the pipe section with water to such a depth that every portion of the pipeline is subjected to a pressure of at least 100kPa.;
- After an initial period of 30 minutes, accurately measure and mark the water level and keep filled for 1 hour;
- Check (or measure) the water level after 1 hour to record the water level;
- The test is successful if the recorded water levels are the same to indicate zero leakage.

PSLD-7.2.7 Water tightness of manholes

Manholes shall be tested for water tightness.

A water test shall be applied for the detection of leakage of manholes. The test shall be applied to manholes in succession, commencing at the upper end of the sewer network. The manhole shall be closed with water tight expanding plugs and the chamber filled with water to the brim. The water shall remain in the manhole for a period of 30 minutes and thereafter shall show no measurable drop for a further period of 48 hours. After the test period, the water shall be released down the sewer pipe.

When performing the air or water test in accordance with clause 7.2 of SANS 1200 LD, no leakage is allowed within the set time.

PSLD-8 MEASUREMENT AND PAYMENT

PSLD-8.1 General

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

“A length of sewer will be included in a certificate measurement for payment only when such length has been completely backfilled, the manhole on both ends completed and the surplus material removed.”

Payment for the manholes will be made only after covers and frames have been installed and the surface of the roadway or sidewalk reinstated or refilled and completed and surplus material removed.

PSLD-8.2 Scheduled Items

PSLD-8.2.1a PIPES - HDPE

REPLACE THE SUBCLAUSE WITH THE FOLLOWING:

Item: Supply, lay, butt-weld, joint, bed and test complete as per Type PE100, PN10 pipes to SANS ISO 4427/SANS 4427, in the following diameters:

a) 110 mm
b) 160 mm
c) 200 mm
d) 250 mm

Unit: m

The tendered rates shall also cover the cost of storing on site, handling, inspecting and cutting of pipes to suit.

PSLD 8.2.1b Random Destructive Testing

ADD THE FOLLOWING PAY ITEM:

Item: Extra over 7.1.1.0 - 7.1.4.0 for destructive testing of pipes (5%) Unit: Sum

The Contractor must allow for 5% destructive testing of all completed welds in the rates tendered. The rates tendered must allow for the replacing as well as the re-welding of any such pipes sections. Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSLD-8.2.3 HDPE Manholes

ADD THE FOLLOWING SUBCLAUSE:

Item: Unit: No

Construct manhole complete from a single length 1000mm Ø HDPE PE100 SN8 pipe shaft (minimum 8kN/m^2 ring stiffness as per ISO 9969 and min 5 mm wall thickness) with inclusion of factory fitted benching (separate item scheduled for types of benching). The manhole must be factory fitted with steps in a staggered pattern and spaced at 250 mm centre to centre and flexible water tight rubber socket joints. Cover slab and lid to be specified as per drawing and measured elsewhere. Including all excavations. Including foundation to be 250 mm thick 25 MPa/19mm concrete filled to fully support benching and to extend 300 mm beyond bottom rim of manhole and cast at 200mm deep, with 200mm thick 25 MPa/19 mm concrete collar at top of manhole to provide a foundation for the cover slab. Refer to drawing N/2281/S/3/001 & 3. For depths:

PSLD-8.2.11 Connecting to Existing Sewer

ADD THE FOLLOWING PAYMENT ITEMS:

(a) Break into existing sewer manholes and connection of new sewer Unit: No

The unit of measurement shall be the number of connections of the new sewer into the existing live manholes indicated on the relevant drawings.

The tendered rate per connection shall include full compensation for all necessary material, labour, plant and tools required to excavated and expose the existing manhole, which the new sewer is to be connected into, and for all additional excavations which may be required to satisfactorily complete the connection, to break into the existing sewer manhole and connect the new sewer including flexible joint, make good any damage caused during the breaking process, and deal with the flow in

the existing sewer. The rate shall also include the provision and reconstruction of the channel in the existing manhole, including all benching, etc., the taking of all necessary preventive and precautionary measures whilst making the connection, blocking off the ends of any sewer pipe which is to be abandoned.

PSLD-8.2.13 Maintain Sewer Flow

ADD THE FOLLOWING PAYMENT ITEM:

Maintain Sewer Flow Unit: No

Provide pumping equipment, pipes, etc. or any other means to maintain flow in the sewer when replacing sewers, connection to existing or new manholes and rebuilding existing manholes for as long as will be required to complete the work. The unit of payment will be No., which will refer to each location or incident where sewage flow will be maintained.

PSLD-8.2.14 Testing of Sewer

ADD THE FOLLOWING PAYMENT ITEMS:

Testing of sewer:

(a) Expose sewer, provide all labour, equipment, including expansible plugs and flexible bag stoppers, perform test and reinstate sewer at test position if required.
Unit: Sum

(b) Provide suitable CCTV equipment including the camera, open and close manholes, perform CCTV survey, record on video tape and hand a copy of the video tape to the Engineer
Unit: m

The rate shall include for all the costs involved to establish the equipment on site, labour to perform the survey, the recording and to close all manholes after completion of the survey.

The unit of payment shall be metre of survey completed.

PSLD-8.2.15 Quality assurance of HDPE welded joints

ADD THE FOLLOWING SUBCLAUSE:

Item: (a) Independent quality control testing of HDPE welded joints Unit: Prov. Sum

(b) Handling costs and charges on (a) Unit : Percentage

The stated provisional sum shall cover the cost for the independent quality control of the welding operations, quality control systems and testing as ordered by the Engineer. The expenditure of this scheduled item is at the discretion of the Engineer and does not relieve the contractor of his obligation to do normal quality control as stipulated.

PSLD-8.2.16 Special Tests Requested by the Engineer

a) Pipeline acceptance control and testing by an independent inspectorate.....Unit: Prov. Sum
b) Percentage charges and profit on a).....Unit: Percentage

The stated provisional sum shall allow for conducting factory and on-site inspections and adjudication of test records that are relevant to the construction of the pipeline (e.g. welds, lining, coating and repairs, etc.) by an independent inspectorate appointed by the Engineer to act on his behalf.

PSLD-8.2.17 Laser Equipment

ADD THE FOLLOWING PAYMENT ITEM:

(a) Provide, operate and maintain laser equipment Unit: Sum

The tendered rate shall cover the cost to provide, operate and maintain the laser equipment to control the levels and gradients of the newly laid sewer pipes.

PSLD 8.2.18 Fat Trap

ADD THE FOLLOWING PAYMENT ITEM:

Item: Supply and install fat trap as specified:

a) 2l/s Fat trap unit complete Unit: No

The rate shall cover the cost of supplying and installation of an approved 2l/s unit fat trap complete.

PSLD 8.2.19 Shower Unit

ADD THE FOLLOWING PAYMENT ITEM:

Item: Supply and install HDPE shower unit as per detail:

a) Shower unit structure complete Unit: No

The rate shall cover the cost of supplying and installation of an approved HDPE shower unit complete.

PSLD-8.2.20 Electrical cable and services detection

ADD THE FOLLOWING SUBCLAUSE:

Item:

(c) Detection of services and cables Unit: Prov. Sum

(d) Handling costs and charges on (a) Unit : Percentage

The stated provisional sum shall cover the cost for the hiring of a specialist contractor to electronically detect underground services, electrical cables, telephone and communication lines as ordered by the Engineer.

PSLE STORMWATER DRAINAGE (SANS 1200 LE)

PSLE 2 INTERPRETATIONS

PSLE 2.1 Supporting Specifications

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

Reference is made to PW 344 Appropriate Development of Infrastructure on Dolomite Manual Department of Public Works. August 2017. **Specific attention is given to Annex P: Specification for HDPE Product Supply, Installation and Quality Control**. In the event that there is a direct contradiction between the aforementioned standard specification document and this document's specifications, the former shall take preference.

PSLE 2.3 Definitions and Abbreviations

(b) **Abbreviations**

ADD THE FOLLOWING TO THIS SUB-CLAUSE:

HDPE	:	High Density Polyethylene
OD	:	Outside Diameter
ID	:	Inside Diameter

PSLE 3 MATERIALS

PSLE 3.1 Culvert Units and Pipes

PSLE3.1.1 HDPE Pipes & Manholes

PSLE3.1.1.1a General Requirements

HDPE pipes shall be either solid wall HDPE or structured wall HDPE pipes.

HDPE pipes shall be PE100 and comply with the requirements of SANS 4427 / ISO 4427. Pipes shall preferably be joined by means of butt welding as per the requirements of SANS 4427. Where permitted in terms of the specification data, pipes may be joined together by means of electro fusion fittings recommended by the pipe manufacturer or butt fusion or hot gas extrusion welding.

All storm water pipe work shall be HDPE up to the maximum sizes available in RSA and/or except where otherwise approved by the Client. Polyethylene pipe raw materials shall comply with the applicable requirements of SANS ISO 4427 Part 1. ****Only pre-compounded from manufacturer virgin materials will be accepted, no recycling or regrinding / reworked allowed**.

The type of pipe must be a HDPE PE100 SN8 pipe (minimum 8kN/m^2 ring stiffness as per ISO 9969 and minimum 5mm wall thickness) or as specified on the drawings or in the Schedule of Quantities. The supplier must have a minimum ISO 9001:2015 accreditation. The HDPE piping shall be supplied in the maximum

possible lengths permitted by diameter and handling constraints. The handling of the piping shall be in accordance with the manufacturer's standards and to the approval of the Engineer.

Should steel reinforced HDPE pipes be used, the mild steel reinforcing must be replaced with Stainless Steel Grade 430 (min) in accordance with the manufacturer's standards and to the approval of the Engineer.

Supply lengths: 12m (minimum)

PSLE3.1.1.1b Quality Assurance

It is the responsibility of the manufacturer/supplier to establish Quality Assurance by means of quality control procedures, which shall ensure that the product will meet the requirements of this specification. The manufacturer/supplier shall maintain a quality system that conforms to the requirements of SANS 9001 / ISO 9001:2015 or national equivalent. Applicable standard for manufacture of pipe shall be SANS 4427 / ISO 4427.

For all relevant requirements, certification or testing that may be necessary for quality assurance of raw material supply, manufacturing standards, equipment used in manufacturing or tests to ensure standards are met, refer to SANS 4427 / ISO 4427, SANS 10268, SANS 10269, SANS 10270, Sans 1655, SANS 1671, SANS 21138, SANS 674, ISO 9969 and relevant specifications.

The manufacture/supplier shall submit the following documents prior to delivery of material to site:

- Certificate of Registration – SANS 9001/SANS ISO 9001:2015 or National equivalent;
- Permit Certification – SANS 4427/SANS ISO 4427 for PE100;
- Quality Control Plan (QCP shall include Raw Material and Product Test Certificates);
- Last two audit reports according to SANS or National equivalent.

The manufacturer must unconditionally guarantee all HDPE products for a period of 100 years against any form of chemical decomposition or mechanical failure as a result of normal use in a 100-year lifecycle of expected pressures.

PSLE3.1.1.1c General Product Requirements

PSLE3.1.1.1c1 General

All finished HDPE products shall be free from cracks, voids, foreign inclusions and other defects, which would impair the overall performance. It shall be smooth walled on inside and outside and shall conform to the requirements (characteristics) outlined below.

PSLE3.1.1.1c2 Characteristics of Raw Material

Raw Material: the HDPE manufacturing substance shall be 100% SANS ISO 4427 PE100 High Stress Crack Resistance certified virgin material (i.e. with ZERO in-house/buy-in reworked materials or scrapings or foreign material), which material shall have been tested in accordance with the ISO13479 Notched Pipe Test by an independent 3rd party laboratory and the time to failure shall have been ≥8,760 hours. HDPE structured wall manufacturing substance shall be 100% SANS ISO 4427 PE100 certified material (i.e. with ZERO in-

house/buy-in reworked materials or scrapings or foreign material), which material shall be subjected and proved to be conforming to testing means and methods specified in SANS 4427.

Raw material declaration: the HDPE product manufacturer must declare in the tender documents the origin (supplier) of the raw material that will be used to manufacture the pipes for the contract. Raw material composition for pipes, fittings (e.g. stubs) and other elements (e.g. sheeting for benching) shall be PE 100 pre-compounded black.

Ash content: To be in accordance with SABS 533 part 1,2 and 3 clause 6.3 maximum not to exceed 0,1%(m/m).

PSLE3.1.1.1c3 Technical Specification for Raw Material and Finished Product

Physical/Chemical Property	Standard	Value	Unit
Density	ISO 1183	0.949 – 0.960	g/cm³
Melt Flow Index (190°C/5kg)	ISO 1133	0.25 – 0,35	g/10min
Vicat Softening Point (5kg)	ISO 306	64 – 68	°C
Crystalline Melting Range	ISO 3146-85	130 – 135	°C
Viscosity Number	ISO 1628-3	390	cm³/g

Mechanical Property	Standard	Value	Unit
Shore D, Hardness	ISO 868	61	–
Elastic Modulus	ISO 527	900 – 1000	MPa
Tensile Yield	ISO 527 / ISO 6259	24	MPa
Ultimate Tensile Strength	ISO 527 / ISO 6259	35	MPa
Ultimate Elongation	ISO 527 / ISO 6259	>600	%
Flexural Stress (3.5% Deflection)	ISO 178	19	MPa
Thermal Stability (OIT @ 210°C)	ISO 10837	≥20	minutes
Carbon Black Content	ASTM D 1603 / ISO 6964	2.25 +/- 0.25	%

PSLE3.1.1.1c4 Pipe Characteristics

Characteristics	Applicable Standard
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness @ any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

PSLE3.1.1.2 HDPE Pipes and Specials

All HDPE fittings and specials shall be moulded (solid wall pipes) and fabricated (structured wall pipes) from pipe complying with the requirements given in PSLE3.1.1.1a. In addition, all pipe fittings and specials shall be free of weld spatter and all sharp corners and edges shall be chamfered smooth.

Welders who are competent in terms of the relevant procedure approval test shall carry out all welding and proof of such competency may be required by the Engineer.

PSLE3.1.1.3 Defects

Each pipe, manhole and welded connection shall be examined for damage both before and after laying or installation. Any damaged or defective pipe, welded connection or manhole must be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

PSLE3.1.1.4 Pipe Joints

All properties of pipe joints designed by the manufacturer must always exceed or be equivalent to the base parent pipe (i.e. joints shall not decrease the tensile strength properties of the overall pipeline).

ADD THE FOLLOWING SUB CLAUSE

Butt-welding of solid and structured wall or other approved pipes and fittings:

Field welding of HDPE pipes and fittings shall comply with all relevant requirements as specified by SANS 10268-1 (Heated tool welding). Field and factory welding shall be executed by personnel qualified to execute such welding. The equipment utilised shall be as specified in SANS 1671-1.

Jointing by means of extrusion welding for structured wall or other approved pipes and fittings:

Jointing of HDPE structured wall or other approved pipes must be through extrusion welding in accordance with SANS 10268 Part 4 Hot Gas Extrusion welding. All welding shall be carried out by the manufacturer or through an approved Sub-Contractor with a proven track record for welding of HDPE pipes. Only external welding of pipe joints will be required on all pipes 650mm diameter and smaller whereas internal as well as external welding will be required for pipe sizes 700mm diameter and greater.

PSLE3.2 Bedding Materials

PSLE3.2.1 General

Bedding material shall conform to SANS 1200/SANS 1200 LB subject to the maximum aggregate not exceeding 6mm and the permeability to be lower than the in-situ soil. Where trench excavated material is utilized for bedding, surround and backfill materials, the materials shall be compacted to at least 93 % Mod AASHTO or the density of the in-situ soil, whichever is higher. Where imported materials are used for trench bedding, surround or backfill materials, laboratory permeability and density tests shall be conducted on both the in-situ trench material and the imported materials to ensure that the bedding, surround and backfill materials are less permeable than the in-situ soil after placement and compaction to at least 93 % Mod AASHTO. Suitable bill items shall be provided in the Schedule of Quantities for all the above work.

PSLE3.2.2 Concrete

Add the following:

For concrete pipes on dolomite underlain land the bedding conditions shall ensure that the deflection tolerances are not exceeded as a result of consolidation settlement to ensure zero leakage from pipes.

PSLE 3.3 Manholes, Catch Pits and Accessories

ADD THE FOLLOWING PAY ITEMS:

PSLE 3.3.2 Catch pits, prefabricated chambers, shafts and Junction boxes

REPLACE THIS SUB-CLAUSE WITH:

For dolomite underlain land manholes and chambers shall preferably be manufactured from structured or solid wall HDPE or steel-reinforced spirally wound HDPE pipes and shall be watertight. HDPE solid wall pipes shall be manufactured according to SANS 4427.

Unless detailed to the contrary on the drawings, or scheduled in the Schedule of Quantities or otherwise instructed by the Engineer, all manholes/catch pits shall be prefabricated in a factory or controlled environment from polyethylene pipe sections as detailed on the typical drawings for stormwater manholes. The manhole sections shall be of type HDPE PE100 SN8 pipes (minimum 8kN/m^2 ring stiffness as per ISO 9969 and minimum 5mm wall thickness). All polyethylene pipes shall comply with the applicable requirements of SANS ISO 4427 and the manufacturer must have a minimum ISO 9001:2015 accreditation.

HDPE structured wall pipes shall be manufactured according to SANS 21138 or SANS 674 in terms of profile, pipe fittings and pipe endings, but with stainless steel stiffeners and 5mm minimum wall thickness. HDPE pipes to be extrusion welded to the manhole.

Benching shall consist of HDPE (PE100 to SANS 4427) flat sheet and pipe of minimum 12mm thickness.

The HDPE manholes shall be manufactured complete with factory fitted benching and steps. All joints to be welded HDPE. The manhole must be completely watertight and withstand the hydrostatic uplift force when empty and the level of the water table equal to the top of the manhole. Foundation to be as per detail drawing, 25Mpa/19mm concrete filled to fully support benching, bottom rim and to extend 300mm beyond bottom rim of manhole main shaft. The top rim should be cut away 200mm beyond bottom rim of manhole and cast at 300mm wide, 200mm 25MPa/19mm concrete collar. Concrete encasement of the bottom section of the manhole may only take place after the prescribed air/hydraulic test has been completed.

PSLE 3.3.4 Steps

ADD THE FOLLOWING TO THE EXISTING SUB-CLAUSE:

Prefabricated polyethylene manholes shall be supplied complete with an approved proprietary step system.

PSLE3.6.2 Covers for HDPE Manholes and Chambers

For HDPE manholes and chambers, the manhole roof shall be an integral part of the chamber wall to form a watertight chamber. The cover (lid) shall be lockable and manufactured from a material that has no monitory value (i.e. steel and CI lids are not acceptable).

PSLE 4 PLANT

PSLE 4.2 Testing

The Contractor shall provide all the equipment, materials, tools and fittings required for the performance of tests as noted under PSLE 7.

PSLE 5 CONSTRUCTION

PSLE 5.1 Trench Bottom

ADD THE FOLLOWING TO THE EXISTING CLAUSE:

“Pipe laying may not commence in trenches prior to the approval by the Engineer.

When the total length of completed storm water pipe which has not yet been commissioned exceeds 100m, no further pipe laying may be done without the Engineer’s approval.”

PSLE 5.2 Bedding and Laying

PSLE 5.2.1 General

ADD THE FOLLOWING TO THE SUBCLAUSE:

“To obviate the effects of thermal expansion and contraction on polyethylene pipes the pipe blanket shall be constructed to a level of 50 mm above the crown of the pipe. All joints shall however remain uncovered until the satisfactory completion of acceptance tests on the pipe”.

PSLE 5.2.2 Pipe culverts

REPLACE THE EXISTING SUBCLAUSE WITH:

Pipelines shall be laid and bedded (see SANS 1200 LB and PSLE 3.3) to even grades and to the levels and alignments shown on the drawings or as directed. Pipes shall be laid centrally in the trench in such a manner that the side allowance conforms to the applicable value specified in Clause 8 of SANS 1200 DB.

The minimum clearance between the outside of a pipeline being laid and the outside of any other pipe that it crosses shall be in accordance with the specifications of SANS 1200 L sub-clause 5.1.4.3.

PSLE5.5 Catchpits, Manholes, Inlets and Outlet Structures

PSLE5.5.1 General

Add the following:

Masonry and concrete manholes and inlets on dolomite underlain land and shall be designed as water-retaining structures and tested for watertightness (zero leakage) using the test procedure in SANS 2001-CC1.

PSLE5.8 HDPE Pipes, Manholes and Chambers

PSLE5.8.1 HDPE Product Supply, Installation and Quality Control

PSLE5.8.1.1 Off-loading of Pipes and Fittings

The manufacturer's instructions regarding the off-loading of all HDPE pipes, fittings and manufactured items must be strictly adhered to. The specifications of such procedures must be in the site office of the contractor at all times. The Engineer must be provided with a copy of such procedures.

The Contractor must clear an area specifically for the purpose of off-loading HDPE products. This area must be free of rocks, boulders or any other foreign objects that may puncture, cut or scar the HDPE fittings, pipes and other manufactured items. The area must also be relatively level in one direction and the ponding of stormwater must not be permitted. The area must be kept in such condition for the duration of material being on site.

PSLE5.8.1.2 Handling of Pipes on Site

The manufacturer's specification for the handling and transporting of material on site must be strictly adhered to. The Engineer shall write a specific instruction regarding this in the absence of such a manufacturer's instruction.

Under no circumstances shall the dragging of pipes on site be allowed. Dragging of the pipe will result in cuts, scratches and puncture marks that may result in weakening of the pipe.

Welded pipes shall be transported to the point of installation in accordance with the manufacturer's specification.

PSLE5.8.1.3 Visual Inspection of Pipes for Defects

The Engineer will inspect all HDPE pipes for any visual defects such as cracks, deformation, wall thinning, etc. This in no means constitute approval of the pipes. It merely serves as an additional quality control feature to ensure that pipes with obvious defects are rejected from the beginning.

Pipes found to have such defects, must also be brought under the attention of the supplier in writing. The suppliers must respond in writing. Copies of such cases must be forwarded to the Engineer. In the event of not resolving such cases, the matter must be referred to the Technical Committee of the South African Plastic Pipe Manufacturing Association (SAPPMA) for comments in terms of SANS ISO 4427: 1996.

PSLE5.8.1.4 Pipe Marking

All HDPE Pipes shall be indelibly marked at 1m intervals with the following details:

Reference Item	**Mark Printed**
Trade name	Manufacturer/Supplier Name
Specification	ISO 4427 / SANS 4427
Pipe OD	e.g. 160
Pipe OD tolerance	Grade B
Wall thickness	e.g. 7,7
Nominal pressure	e.g. PN 10
Material designation	PE 100
Batch No.	Manufacturer/Supplier Trace ability
Application	SEWER or WATER or STORMWATER or "SLEEVE-WATER" or any other application

PSLE5.8.1.5 Inspection of Installed HDPE Pipes by Engineer

The Engineer shall be notified to inspect all HDPE pipes and fittings 24 hours prior to backfilling of trenches. All pipes with cut, scratch, puncture marks or signs of deforming will be rejected from a quality control perspective. In such cases, the Contractor must submit a certificate of approval from the pipe supplier. This document must clearly state that the supplier approved the integrity of the pipes, irrespective of the noted damages. If such an approval certificate is not supplied, the Engineer reserves the right to reject such parts of the installation as he/she sees fit.

Any dispute in this regard must be referred to the Department of Public Works Project Manager.

PSLE5.8.1.6 Cover

For HDPE pipes the minimum soil cover shall be:

Average : 750mm
Outside traffic areas : 600mm
Inside traffic areas : 1000mm

Where these minimum thicknesses cannot be met, appropriately designed concrete slabs shall be used as protection or if imposed loads necessitate protection.

PSLE5.8.2 Jointing Methods

PSLE5.8.2.1 Welding of HDPE

The welding of HDPE using the heated tool butt welding and heated tool socket welding processes shall be undertaken in accordance with the requirements of SANS 10268-1 using equipment that satisfies the requirements of SANS 1671-1.

HDPE pipes to be extrusion welded to the manhole in accordance with SANS 10268-4.

The welding of HDPE pipes by means of electro fusion shall be in accordance with the requirements of SANS 10268-2. The acceptability of the weld shall be assessed in accordance with the assessment table contains in SANS 10268-10.

Welders shall, where specified, be tested and certified in accordance with the requirements of SANS 10269 and be in possession of a valid test certificate. Welders shall be trained by a registered Mersita training facility with a minimum NQF 3 qualification.

Before use, metal heating plates shall be cleaned of all traces of polyethylene remaining from previous operations to avoid inclusion of oxidized polyethylene in the weld.

The end of all pipes jointed by means of an electrofusion fitting, shall be prepared prior to jointing by scraping off any surface oxide and being thoroughly cleaned with a suitable cleaner. Angle grinders shall not be used for preparing surfaces.

The two elements that are to be jointed in the butt-welding process, shall not be under tension or lateral stress during the welding operation.

PSLE5.8.2.2 Removal of HDPE Pipe Shavings

During the preparation phase of welding surfaces, all care must be taken to ensure that pipe shavings are not left behind in pipes.

The entire system should be monitored for blockages after installation and the Engineer shall introduce measures to ensure that the rectification of blockages remains the responsibility of the Contractor for the duration of the contract up to final delivery.

PSLE 5.9 Action to be taken during and after testing (Additional Sub-clause)

The Contractor shall make good any defects that may be found during the testing of the storm water pipe thereafter the test shall be repeated at his expense until the storm water pipes are found to comply with the specification.

PSLE 7 TESTING FOR LEAKAGE

PSLE-7.2 Tests and Acceptance/Rejection Criteria

PSLD-7.2.1 General

Testing as contained in ISO 4427 / SANS 4427 shall apply. Tests shall also be conducted ad-hoc by a registered and authorised testing body as approved by the Department of Public Works.

PSLE- 7.2.2 Raw Material Acceptance Tests

The material used for the production of the pipes and fittings or structures, shall be high-density polyethylene (HDPE) PE 100. To confirm the quality of this product, the following test shall be performed.

- Density
- Melt Flow Index
- Carbon Black content
- Carbon Black distribution

PSLE-7.2.3 Testing of HDPE welding

For weld joint evaluation, water pipes are classified as Assessment Class 1, according to SANS 10268-10. Tests on welds shall be performed according to the requirements of SANS 6269 and all pipe system weld factors shall be ≥1.

The Contractor shall submit to the Engineer the results of tensile, bend and peel tests performed according to SANS 6269 by the manufacturer on each batch of HDPE pipe delivered to site.

The Engineer shall visually inspect all welds on site, including welding rod property evaluation as required. The Engineer shall have 1% of all welds performed removed (sampled) and tested for tensile strength according to SANS 6269 by an approved independent and accredited testing facility.

PSLE-7.2.4 Pressure testing of HDPE pipes in Laboratory

The Contractor shall provide for quick pressure testing of all pipe sizes delivered to site with at least one test per 250m of sewer pipe.

The pressure test involves:

- Selection of 3 samples, at random by the independent test laboratory, of pipes having a minimum length of 1m with all relevant pipe markings on and free of scratches and defects;
- Conditioning of the pipe or fitting in water for 12 hours at 20°C;
- Standard pressure test procedures according to ISO 4427;
- Failure test: apply internal pressure at 5bar/min until failure – PE 100 pipes must reach a pressure of at least twice the Minimum Required Strength (MRS) as per ISO 4427 / SANS 4427;
- Upon failure to pass the test procedure

PSLE-7.2.5 Permissible Leakage Rates

The permissible leakage rate for HDPE pipes, manholes and inspection chambers shall be zero.

PSLE7.2.6 Testing of HDPE pipe sections

All completed stormwater lines shall be satisfactorily tested and no payment in respect of pipe laying or the supply of pipes and fittings on any section of pipeline shall be made until such tests have been completed successfully.

Air tests shall be carried out on approved completed pipe sections with suitable length as approved by the Engineer.

The Contractor shall be responsible for arranging all aspects of air testing and for the supply of all equipment, materials and labour required.

The maximum air test pressure for field testing shall be 100kPa.

The air test procedure shall be as follows:

- Isolate the section of pipe to be tested by inserting airtight packers, one of which is connected to the air testing machine;
- Gradually raise the gauge pressure in the pipe in 10kPa steps, with a 2-minute stabilisation period between steps, to 100kPa and ensure that there is no air leakage at the packers;
- Switch off the machine and keep the pressure in the pipe for 1 hour. After 1 hour, the gauge reading shall remain constant to indicate zero air leakage;
- If the gauge reading reduces by more than 1% over 1 hour, the pipe shall be deemed to have failed the air test and the pipe test section rejected;
- Upon completion of the air test, gradually decrease the pressure to zero over a period of 20 minutes;
- After rejection of a pipe section that has failed the air test, the Contractor may apply a water test to locate the source of failure, rectify the pipe section and re-apply the air test. The pipe section will be accepted if zero leakage is achieved.

Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury.

The water test procedure shall be as follows:

- Fill the pipe section with water to such a depth that every portion of the pipeline is subjected to a pressure of at least 100kPa;
- After an initial period of 30 minutes, accurately measure and mark the water level and keep filled for 1 hour;
- Check (or measure) the water level after 1 hour to record the water level;
- The test is successful if the recorded water levels are the same to indicate zero leakage.

PSLE 7.2.7 Rejection

"Clause 7.2.3: Rejection" of 1200 LD shall apply to this section **in all respects.**

ADD THE FOLLOWING TO CLAUSE 7.2.3 OF SANS 1200 LD:

Include Polyethylene pipes to the pipe selection type subject to failure of air test.

PSLE 7.2.8 Water tightness of manholes

Manholes shall be tested for water tightness.

A water test shall be applied for the detection of leakage of manholes. The test shall be applied to manholes in succession, commencing at the upper end of the storm water network. The manhole shall be closed with water tight expanding plugs and the chamber filled with water to the brim. The water shall remain in the manhole for a period of 30 minutes and thereafter shall show no measurable drop for a further period of 48 hours. After the test period, the water shall be released down the storm water pipe.

When performing the air or water test in accordance with clause 7.2 of SANS 1200 LD, no leakage is allowed within the set time.

PSLE 7.2.9 Initial tests on welded HDPE pipes and fittings

All welding of HDPE piping shall be as specified in SANS 10268 – Part 1 (Heated tool welding) and SANS 10268 Part 4 (Hot gas extrusion welding) and which will be subject to acceptance testing in accordance with SANS 10268 Part 10, assessment class 1 (Weld Defects).

The Contractor must institute an acceptable quality control and monitoring procedure so that accurate records are kept for all welds. **Weld records include pipe section info, date, time, welding operator, GPS coordinate and photograph of weld.** The control of welding procedure is solely the responsibility of the Contractor and adequate provision must be made in the priced rates to accommodate the quality control.

Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSLE 8 MEASUREMENT AND PAYMENT

PSLE 8.2.1a ADD THE FOLLOWING TO THE SUB CLAUSE

Supply, handle, lay, weld joints, bed in Class B and test HDPE PE100 SN8 pipes (minimum 8kN/m^2 ring stiffness as per ISO 9969 and minimum 5mm wall thickness) for the following diameters:

a) 450 mm
b) 500 mm
c) 560 mm
d) 600 mm

e) 700 mm
f) 750 mm
g) 800 mm
h) 900 mm
i) 1000 mm Unit: m

Only external welding of pipe joints will be required on all pipes 650mm diameter and smaller whereas internal as well as external welding will be required for pipe sizes 700mm diameter and greater.

PSLE 8.2.1b Random Destructive Testing

ADD THE FOLLOWING PAY ITEM:

Item: Extra over 8.1.1.0 - 8.1.1.9 for destructive testing of pipes (5%) Unit: Sum

The Contractor must allow for 5% destructive testing of all completed welds in the rates tendered. The rates tendered must allow for the replacing as well as the re-welding of any such pipes sections. Both the welding procedure and testing shall be monitored regularly and the welding of pipes stopped if any deviation from the specification is detected. The Contractor shall make the necessary changes to the procedure in order to allow welding to continue. NO additional time will be considered for such delays.

PSLE 8.2.7 ADD THE FOLLOWING TO THE SUB CLAUSE

ADD THE FOLLOWING PAY ITEM:

Item: Extra over 8.2.5.2 to 8.2.5.19 to factory fit HDPE manholes with connections. channels and benching for site welding on (not rubber socket ends) of HDPE pipes of nominal diameter and configuration as follows:

a) 450mm Ø outlet
No. Inlets Unit: No

b) 500mm Ø outlet
No. Inlets Unit: No

c) 560mm Ø outlet
Inlets Unit: No

d) 600mm Ø outlet
Inlets Unit: No

e) 700mm Ø outlet
Inlets Unit: No

f) 750mm Ø outlet
Inlets Unit: No

g) 800mm Ø outlet
Inlets Unit: No

h) 900mm Ø outlet
Inlets Unit: No

i) 1000mm Ø outlet
Inlets Unit: No

PSLE 8.2.8 HDPE structures

ADD THE FOLLOWING PAYMENT ITEMS:

Item: Supply and install Manholes, Catchpits and the Like

d) Type 1: Grid inlet over manhole complete
e) Type 2: Grid inlets next to runways and taxiways complete
f) Type 3: Grid inlet at down pipes excl. HDPE MH
g) Type 4: Grid inlet in building courtyards Complete Unit: No.

The rate shall cover the cost of supplying and installing the iron anchor, grating and angle iron frame to seat grating as well as supplying and casting concrete for grating and benching, steel reinforcement, fixing and stripping formwork and steel float finish as per detail DWG N/2281/SW/3/002. The rate shall also cover the reinstating of the area around the structure after completion. Complete unit to be hot dip galvanised after manufacturing and to be "banded".

h) Salberg type kerb inlet complete Unit: No.

The rate shall cover the cost of ordering, supplying and installing the precast Salberg Type 3 kerb inlets or similar approved by the engineer as per detail DWG N/2281/SW/3/001. The rate shall also cover the excavation, fixing of formwork, steel reinforcing, supplying concrete, casting and steel float finish of the concrete apron slab next to the precast kerb inlet as well as the above mentioned for the kerb transition. The rate shall also cover the reinstating of the area around the structure after completion.

i) Manhole cover slab complete Unit: No.

The rate shall cover the excavation, fixing of formwork, steel reinforcing, supplying concrete, casting and steel float finish of the in-situ concrete slab on top of the ring beam measured separately as per detail DWG N/2281/SW/3/001. The precast/cast-iron cover and frame or similar approved by the engineer to also be measured elsewhere. The rate shall also cover the reinstating of the area around the structure after completion.

j) Manhole Pre-manufactured HDPE

Item: Supply, lay, butt-weld, joint and test complete Type HDPE PE100 SN8 pipe (minimum 8kN/m^2 ring stiffness as per ISO 9969) manholes, in the following depths:

a) 0000 – 1000mm
b) 1000 – 1500mm
c) 1500 – 2000mm
d) 2000 – 2500 mm
e) 2500 – 3000 mm
f) 3000 – 3500 mm Unit: No.

Construct manhole complete from a single length 1000mm, 1200mm or 1500mm diameter HDPE PE100 SN8 pipe (minimum 8kN/m^2 ring stiffness as per ISO 9969 and minimum 5mm wall thickness) with inclusion of factory fitted benching (separate item scheduled for types of benching), step irons and flexible water tight rubber socket joints HDPE pipes welded to manholes. Cover slab and lid to be specified as per drawing and measured elsewhere. Including all excavations. Foundation as per detail to be 25MPa/19mm concrete filled to fully support benching, bottom rim and to extend 300 mm beyond bottom rim of manhole and cast at 300mm wide, 200mm thick 25MPa/19 mm concrete collar at top of manhole to provide a foundation for the cover slab as per detail drawings N/2281/SW/3/001 & 5.

k) Stilling basin type 1 complete Unit: No.

The rate shall cover the cost of supplying of all materials and constructing of the type 1 stilling basin as per detail DWG N/2281/SW/3/003. The rate shall also include the excavation, fixing of formwork, steel reinforcing, supplying concrete, casting and steel float finish of the concrete. The rate shall also cover the reinstating of the area around the structure after completion.

l) Water/oil separator structure complete Unit: No.

The rate shall cover the cost of supplying of all materials and constructing of the water/oil separator as per detail DWG N/2281/SW/3/008. The rate shall also include the excavation, fixing of formwork, steel reinforcing, supplying concrete, casting and steel float finish of the concrete. The rate shall also include the supplying and installing the stainless steel separator plate. The rate shall also include the supply and installation of pipe work to connect the separator structure to the HDPE stormwater network.

The rate shall also include the supply of materials and installation of a Type 1 grid inlet over manhole. The rate shall also cover the reinstating of the area around the structure after completion.

PSLE-8.2.15 Quality assurance of HDPE welded joints

ADD THE FOLLOWING SUBCLAUSES:

Item:	(a)	Independent quality control testing of HDPE welded joints	Unit: Prov. Sum
	(b)	Handling costs and charges on (a)	Unit : Percentage

PSLE-8.2.16 Special Tests Requested by the Engineer

Item:	(a)	Pipeline acceptance control and testing by an independent inspectorate	Unit: Prov. Sum
	(b)	Percentage charges and profit on a)	Unit : Percentage

The stated provisional sum shall allow for conducting factory and on-site inspections and adjudication of test records that are relevant to the construction of the pipeline (e.g. welds, lining, coating and repairs, etc.) by an independent inspectorate appointed by the Engineer to act on his behalf.

PSLE 8.2.17 Laser Equipment

ADD THE FOLLOWING PAYMENT ITEM:

a) Provide, operate and maintain laser equipment Unit: Sum

The tendered rate shall cover the cost to provide, operate and maintain the laser equipment to control the levels and gradients of the newly laid stormwater pipes.

PSLE-8.2.18 Testing of Stormwater

ADD THE FOLLOWING PAYMENT ITEMS:

Testing of stormwater:

(c) Expose stormwater, provide all labour, equipment, including expansible plugs and flexible bag stoppers, perform test and reinstate stormwater at test position if required.
Unit: Sum

(d) Provide suitable CCTV equipment including the camera, open and close manholes, perform CCTV survey, record on video tape and hand a copy of the video tape to Engineer
Unit: m

The rate shall include for all the costs involved to establish the equipment on site, labour to perform the survey, the recording and to close all manholes after completion of the survey.

The unit of payment shall be metre of survey completed.

PSLE-8.2.19 Electrical cable and services detection

ADD THE FOLLOWING SUBCLAUSE:

Item:

(a) Detection of services and cables Unit: Prov. Sum

(b) Handling costs and charges on (a) Unit : Percentage

The stated provisional sum shall cover the cost for the hiring of a specialist contractor to electronically detect underground services, electrical cables, telephone and communication lines as ordered by the Engineer.

B2: PARTICULARS OF PUMP EQUIPMENT REQUIRED

PSX1 PUMPS

Reference drawings:

- **Water Reticulation: Fire Pump Station: Sheets 1 – 5 N/2281/W/6/001-5**

The following Specifications are to be read in conjunction with this Section:

- Technical Specification : Pumps, Pipework and Ancillary Equipment

PSX1.1 General Requirements

The pumping station will house the pumps. One duty and one standby pump are required under this Contract to serve as pressure boosting pumps in the unlikely event of a fire occurring. These pumps have been supplied by others in the previous contract.

The duty point of one pump in operation is **100 litre/s at a head of 35m**. A Bermad pump control valve will be installed after the pumps and this duty point might be moved along the pump curve to ensure better efficiencies. Pumps with a rotational speed of 1500 rpm or less are required.

The maximum backpressure at the suction end of the pump is estimated at **60m (6.0 bar max)** and **20m (2.0bar min)** provision must be made to accommodate such pressure.

~~Should a Tenderer offer equipment and pipework that does not suit the Engineer's proposals for the layout and/or the types and sizes of the pipes, valves, specials, etc., he shall submit with his tender dimensioned drawings and specifications in triplicate, that show his proposals in full detail.~~

The cost of the Tenderers proposal must be included in the relevant items scheduled in the Bill of Quantities.

All pump sets must be complete with motors directly coupled to them, together with all necessary shafts, flexible couplings, base frames, instrumentation and safety covers. Flanges of both the suction and delivery shall be drilled to suite the flanges specified for the pipe specials to be connected to them with a minimum of Class 16 (Table 1600/3 of SANS 1123).

~~It is a requirement that all pumps be supplied with mechanical seals.~~

~~The motor must be supplied with anti-condensation heaters, rating plate and direction of rotation plate.~~

~~Time spent altering drawings and in obtaining the approval of the Engineer, shall not be considered as grounds for an extension of Time for Completion of the Contract. The Contractor shall, if he desires to do so, take cognisance of this fact in quoting his "Supply and Delivery" and "Installation and Commissioning Period"~~

New plinths for these pumps will be constructed by the main civil contractor to the detail provided by the Mechanical contractor.

Tenderers are required to indicate any limitations or required operating procedures applicable to the equipment offered.

The Tenderer is to supply all relevant information regarding the equipment offered, in the applicable Technical Data Sheets (yellow pages) found after the Schedule of Quantities)

A common mild steel base-plate must be supplied for the pumps and motors. The base-plate must be hot dipped galvanised in accordance with the requirements of SANS EN 10240 : 1997 and SANS ISO 1461 : 1999.

~~Performance Penalties will be applicable according to Clause 1.3.5 of Technical Specification: Pumps, Pipework and Ancillary Equipment. Penalties as a result of measured efficiencies lower than the guaranteed duty point efficiencies by more than 2% shall be calculated as follows. A penalty of R25 000,00 will be applicable for every kilowatt by which the gross demand exceeds the guaranteed figure.~~

PSX1.2 Monitoring and Control

The following monitoring devices are required:

- Glycerine filled pressure meters (100 mm dia) on each pump suction and delivery. The pressure gauges must be calibrated and a calibration certificate issued.
- Pressure (no flow) switch on delivery pipe of each pump.

The basic operation procedure will entail that the operator be allowed to control the pump sets locally from the pumping station in the event of a fire occurring and insufficient pressure is available.

PSX1.3 Measurement and Payment

Pump complete with motor, baseplate, monitoring devices, etc Unit: No

Measurement and payment will distinguish between supply/delivery and install/commissioning.
The rate for supply and delivery must include the motor, anti-condensation heaters, rating plate and direction of rotation plate, monitoring devices, coupling, safety covers, base plates, anchor bolts, testing and the painting of the pump and motor to the specified colour code. The rate tendered for installation and commissioning must include mounting on the baseplate, fully aligning the pumpset, grouting in the anchor bolts, fixing, painting, marker plates and training of the Employer's operators.

The piping on the suction and delivery sides will be measured separately. **Refer PSX2.**

PSX2 PIPEWORK

Reference drawings:

- **Water Reticulation: Fire Pump Station: Sheets 1 – 5 N/2281/W/6/001-5**

The following Specifications are to be read in conjunction with this Section:

- Technical Specification : Pumps, Pipework and Ancillary Equipment
- SANS 1200L : Medium Pressure Pipelines

PSX2.1 General Requirements

All pipes and specials shall be manufactured from Grade 300 WA steel as prescribed in SANS 1431 unless otherwise stated.

Unless otherwise stated, all steel pipes are to receive coatings and linings consisting of an approved epoxy, applied according to the Specification. The Tenderer is to supply all relevant information regarding the coating offered, in the applicable Technical Data Sheet (yellow pages) found after the Schedule of Quantities.

All flanges shall be minimum Class 16 (Table 1600/3 of SANS 1123).

PSX2.2 Measurement and Payment

Measurement and Payment will distinguish between supply/delivery and installation / commissioning.

The rates offered under the supply and delivery of pipework must include the cost of manufacture, delivery, coating, protection of the coating during storage and installation, marking, all welding and coating inspections and documentation.

The rates tendered under installation/commissioning must include for the installation of the items including all alignment, use of temporary supports, etc. The rates must also include for the commissioning of an item (e.g. pump control valves).

The supply, delivery, installation and commissioning of the pipework, valves and specials inside the

pump station is included in this Contract.

PSX3 VALVES

The following Specifications are to be read in conjunction with this Section:

- Technical Specification : Pumps, Pipework and Ancillary Equipment
- SANS 1200L : Medium Pressure Pipelines

PSX3.1 General

All valves must be provided with state of valve indicators.

Handwheels shall have the words 'OPEN' and 'CLOSED' cast into it together with arrows indicating the open and closed direction.

The valve class must be stamped clearly on each valve together with the item number as listed in the pipe item list.

Gears, where required, shall be machine cut and enclosed in an IP 65 rated enclosure.

Any valve with an extended spindle of longer than 1 m must have two universal joints fitted in the spindle to cater for any misalignment.

All valves are to be coated and lined with Sigamaguard EHB applied strictly in accordance with the manufacturers specification to a minimum dry film thickness (DFT) of 250 μm. All epoxy coatings are to be applied in accordance SANS 1217.

The Tenderer is to supply all relevant information regarding the equipment offered, in the applicable Technical Data Sheet (yellow pages) found after the Schedule of Quantities.

PSX3.2 Butterfly Valves

Butterfly valves shall be doubled flanged, full-bore types unless otherwise specified.

Butterfly valves shall be generally in accordance with BS 5155.

The disc shaft end not connected to the gearbox or handle must penetrate the valve body so that limit switches can be connected to it.

The seal and valve disc shaft must be replaceable. It must be possible to replace the valve seal form the downstream side of the valve without removing the valve from the pipeline.

All valves may be of the single offset design unless specifically indicated otherwise.

All gears with ratios of 1:3 and lower shall be fitted with easily replaceable shear pins to prevent damage to the valve if excessive force is applied.

PSX3.3 Gate Valves

Gate valves shall be doubled flanged and be of the resilient seal or wedge-gate type, the gates of which shall be completely clear of the waterway in the fully open position. Unless otherwise specified, the gate valves shall be of the non-rising spindle type. The valves shall be capable of withstanding the nominal pressure (PN) and specified test pressures from both sides. The gate shall operate satisfactorily under the specified conditions.
The valves shall generally be manufactured in accordance to SANS 664 and SANS 191.

Gate valves shall be capable of being opened or closed under an unbalanced pressure equal to the design pressure. The effort required on hand wheels to open or close valves under these conditions shall not exceed 250 N in the case of valves up to 300 mm and shall not exceed 400 N in the case of larger valves.

Provision shall be made for glands to be repackable under pressure without shutting off the water.

The spindles shall be of stainless steel while the spindle nut shall be of aluminium - bronze.

PSX3.4 Non-return Valves

All non-return or reflux valves shall be of the slanted seat type and fitted with dampening mechanism to prevent slamming. The body seat ring, disc facing ring, shaft and connecting bolts shall all be of stainless steel.

PSX3.5 Measurement and Payment

Measurement and payment items will distinguish between points of installation as indicated on pipe item schedules as well as between supply/delivery and installation/commissioning.

The rates offered under the supply and delivery of valves must include the cost of manufacture, delivery, coating, protection of the coating during storage and installation, marking and coating inspections and documentation. Rates offered are to include for all nuts, bolts and packings required for completing the installation of the valves listed in the tender.

The rates offered under install and commissioning is to include for any commissioning, calibration and/or settings that any of the valves may require.

PSX4 PIPE SUPPORTS

Reference drawings:

- **Water Reticulation: Fire Pump Station: Sheets 1 – 5 N/2281/W/6/001-5**

The following Specifications are to be read in conjunction with this Section:

- Technical Specification : Pumps, Pipework and Ancillary Equipment
- SANS 1200HA : Structural Steelwork

PSX4.1 General Requirements

Pipe supports are required at various locations to support pipes, valves, fittings, etc. Steel supports, as indicated on drawings, are to be supplied and installed by the under this Contract. The supports are to be hot dipped galvanised in accordance with the requirements of SANS EN 10240 : 1997 and SANS ISO 1461 : 1999.

PSX4.2 Measurement and Payment

The rate for the support shall include supplying the material, manufacturing, installation, and corrosion protection, drilling of holes in concrete, all bolts, straps and packing material. The rate will also include for formwork, reinforcing and concrete where applicable. Supports will be measured by number and different supports will be measured separately.

PSX5 GANTRY HOISTS

PSX5.1 High Lift Pump Station

A gantry beam with a manually operated crab and hoist is required in the pumping station. The I-beam is being supplied under the Civil Contract and the hoist and crab is to be supplied under this Contract. The following dimensions and duties are required:

- Length of travel : 14.66 m
- Height (floor to bottom of beam) : 4.175 m
- Minimum lift height : 0,5 m
- Working load : 2000 kg
- Gantry beam : 305 x 165 x 46 kg/m

PSX5.3 Measurement and Payment

Measurement and payment will distinguish between supply/delivery and installation/ commissioning and also between the different installations.

The rate for supply and delivery must include for the design, detailing and working drawings for a manually operated crab and hoist for an I beam type crawl beam. The rate shall further include delivery and site handling, and all corrosion protection, testing, and labelling.

The rate tendered for installation and commissioning must include mounting, grouting in the anchors (where required), fixing, and training of the Employer's operators etc.

PSX6 ELECTRICAL AND CONTROL

All information/specifications pertaining to the electrical and control portion of the works is included in Section 3.3 : Particular Specifications of the tender document.

C3.3 PARTICULAR SPECIFICATIONS

In addition to the Standardised and Project Specifications, the following Particular Specifications shall apply to this contract and are bound in hereafter.

a) Particular Specifications

The following Additional Specifications for work not covered by the SANS 1200 Standardised Specifications and Project Specifications are applicable to this contract:

PA : Dynamic Compaction
PB : Blasting Operations
PE : Subsurface Grouting
PF : Building Work
PL : Pipe Jacking and boring
PM : Technical Specification: Pumps, Pipework and Ancillary Equipment
PO : Occupational Health and Safety
PP : Environmental Management

PA PARTICULAR SPECIFICATION: DYNAMIC COMPACTION

PA 1 TENDERER' S EXPERIENCE

Tenderer is to submit in document DPW-09 EC of returnable documents details regarding experience in field of dynamic compaction or shall reference experience of the Subcontractor who will be responsible for the execution of this work.

PA 2 EQUIPMENT

Equipment shall comprise of the following mobile unit/s:

1. Mobile Crane 60 tons fitted with boom and appropriate cable, clutch and braking system to handle (*12 tons) free falling square tamper with face not to exceed:

   1,0x1,0 m as well as a 12-ton ball type tamper of 900 mm diameter face and a 3,0 m diameter 12-ton ironing tamper.

2. The Boom configuration shall allow drop height of 18 meters measured from normal ground level whilst closest portion of the crane is a minimum of 13 metres away from point of impact. Furthest point of impact to be possible shall be a minimum of 20 meters

3. Crane to stay stable in the event of weight dropping into a cavity beyond its normal cable and braking configuration.

4. Cable shall allow for accidental dropping to a depth of 20 meters below ground level.

Details of equipment to be furnished in document DPW-23 EC of returnable documents.

PA 3 ADDITIONAL EQUIPMENT AND LOSS OF EQUIPMENT

Compaction is carried out in areas of highly compressible material in which subsurface cavities do exist. The Contractor shall provide for replacement of the tamper in the event of losing it.

The Employer or Engineer shall not be responsible or liable for any damages or loss of equipment. Tenderer shall take note of the adverse soil conditions as described previously.

PA 4 CONTRACTOR'S SUPERINTENDENCE

No work shall be executed unless supervised by a Suitable Representative of the Contractor who shall be made known, in writing, to the Engineer for his approval prior to commencement of the work.

PA 5 SETTING OUT OF THE WORKS

The Engineer shall set out the external boundaries of the compaction area with the Contractors' representative present.

PA 6 PRIORITY OF COMPACTION SEQUENCE

The Engineer reserves the right to determine priorities regarding the sequence of compaction at different sites.

PA 7 STANDING TIME

No provision or claims for standing time shall be heard or allowed. In the event of insufficient information to continue compaction due to lack of information or uncertainty regarding compaction sequence or the location of marked compaction positions the Contractor shall inform the Engineer 6 hours (normal business hours) in advance of planned execution of work.

PA 8 LOCATION, PROTECTION AND DAMAGES TO EXISTING SERVICES

The Engineer shall furnish the Contractor with locations and routes of sub surface services within an accuracy of ± 5 m. The Contractor shall excavate up to a depth of 1,5 meters to expose such services if deemed necessary by the Engineer.

Repair of damages to under/above ground services shall be for the account of the Contractor once the position of such service was known to the Contractor or indicated by the Engineer.

All damages to be reported to the Engineer within 1 (one) hour of occurrence. The Contractor needs to submit a full damage report within 24 hours.

PA 9 INITIAL SITE ESTABLISHMENT AND TIME RELATED COST

PA 9.1 Site establishment

Site establishment shall include provision on the site of required equipment ready for work at the first site of work. It shall also include removal from the site of the aforementioned equipment and all costs related thereto. The Engineer reserves the right to terminate the Dynamic Compaction work at any time, or change the tamper size or drop height, if to his discretion the required effect is not obtained. In the event of termination, the cost of Site Establishment plus the completed work measured in m^2, shall be deemed as full payment of work executed. No other claims for this stoppage of work shall be heard from or claimed by the Contractor.

PA 9.2 Movement on site

Movement on the site shall include the full cost of moving and downtime related costs of all crew and machinery between any two sites. It shall further include setting up the equipment and setting out the desired compaction grid as per engineering drawing N/2281/G/7/001.

Please note the movement on the site is restricted and road traveling of the crane may not always be possible. Rates for movement of the crane, between sites, under own power as well as per truck are allowed for in the Schedule of Quantities.

PA 10 DYNAMIC COMPACTION

PA 10.1 Preparation work

The sinkhole or doline needs to be excavated to depth as directed by Engineer. The base of excavated area is to be levelled off using the excavator bucket if required.

PA 10.2 Compaction

Compaction to be executed by dropping the weight from an 18 meter height in the desired pre-marked pattern to result in an even distribution of

a. Primary compaction 15 blows per 25 m^2 Engineer to specify
b. Secondary compaction 15 blows per 25 m^2 Engineer to specify
c. Ironing/finishing compaction 2 blows per m^2 Engineer to specify

The compaction imprints shall be filled once it exceeds 700 mm in depth and between each compaction phase. The Contractor needs to record the settlement of each blow or number of blows as may be required by the Engineer.

As alternative can the Engineer specify the depth of influence required as well as the required compaction density at specified depths. In such cases shall the Tenderer submit a proposed method of work with the Tender.

PA 10.3 Measured quantity in bills

Tenderer to note that the quantity allowed for in the Schedule of Quantities are provisional and could change depending on the site conditions encountered.

PA 11 FIELD REPORT

The Contractor to provide marked drawings showing location of pre-marked grid and subsequent compaction imprints as well as the settlement per blow.

PA 12 TESTING

Plate load testing is measured in the Schedule of Quantities as well as a provisional sum for the ordering of tests as required by the Engineer.

PA 13 MEASUREMENT AND PAYMENT FOR SINKHOLE REPAIR WORKS

PA 13.1 Site establishment

Item: Allow for site establishment of Dynamic compactor and ancillary equipment for sinkhole repair. Unit: Sum

The rate shall include all items for bringing the plant to site, setting up all ancillary equipment, watching, security, maintenance of plant through out the duration of the contract period and all standing time.

PA 13.2 Dismantling and re-erection for movement on the site under own power

Item: Allow for dismantling and re-erection for movement on site under own power

Unit: No

The rate is for the number of times the machinery shall be dismantled and moved to a new site within the same project area and or contract.

PA 13.3 Dismantling and re-erection for movement on the site per truck

Item: Allow for dismantling and re-erection for movement on the site per truck

Unit: No

The rate covers the same item as PA 13.2 but for movement when equipment is mounted on a low bed or any other such truck. It includes for loading, traveling and unloading machinery within different sites on the same project area and or contract.

PA 13.4 Movement on the site under own power

Item: Allow for movement on the site under own power.

Unit: km

The rate covers the actually amount of distance covered.

PA 13.5 Protection to paved surfaces whilst moving on the site under own power

Item: Allow for protection to paved surfaces whilst moving on the site under own power.

Unit: m²

The rate shall cover all costs to protect and repair (if required) all paved surfaces traversed in moving between sites.

PA 13.6 Movement on the site per truck

Unit rate: No

PA 13.7 Dynamic compaction

Item: Allow for dynamic compaction of the sink hole previously choked as described above.

Unit rate: blow

Rate to cover work described in Clauses PA 10 and 11 as well as all related hiring, operational and overhead costs for the plant and related personnel on site for duration of execution. Rate to be paid as the number of blows counted to suit requirements of Clause PA 10.2, namely number of blows represent 1,0 m² treated. Compaction shall be done on a 5m x 5m grid as indicated on drawing N2281/G/7/001. One blow shall be calculated as the dropping of a 12-ton weight from 18 meters and shall be proportionally adjusted for different height and tamper weights as requested by the Engineer as follow:

One blow = actual drop height (m) x actual tamper weight (ton)
18 meter = specified drop height, 12 ton= specified tamper weight

PA 13.8 Plate load testing

Item: Plate load testing

Unit rate: No

The rate is payable per number of times plate loading is undertaken to test for the required compactive effort.

The rate also includes load testing up to 1000 kPa on 600 mm diameter plate.

PB PARTICULAR SPECIFICATION: BLASTING OPERATIONS

General recommendations hereunder to be read with all SANS/SANS and related specifications regarding blasting. Applicable anywhere in dolomitic areas.

a. Inter-shot delay between rows to be minimum of 25 ms;
b. Charge per delay should be in accordance with AECI specification for blasting adjacent to private property;
c. **All underground services to be treated as structures;**
d. PPV not to exceed 12 mm/s at frequency not less than 10 Hertz;
e. Preference to be given to handidets system.

PE PARTICULAR SPECIFICATION: SUB-SURFACE GROUTING

This section deals with the grouting of subsurface cavities with a pumpable concrete or soilcrete mixture. Work comprises of the pumping of grout mix directly from the mixing truck or stationary mixer into 50 mm HDPE housing connected to 50 mm steel piping down a previously drilled borehole to depths as indicated by the Engineer. Execution of each pumping operation shall be continuous and thus shall the Contractor provide for instances where grouting continues after normal working hours. The Contractor shall be liable for any work not executed as per specification and shall redo faulty work at own expenses if ordered to do so. The Employer will not be liable for any losses or damages to any equipment.

PE 1 TENDERER' S EXPERIENCE

Only offers from Tenderers with proven past experience of grouting of subsurface cavities in dolomitic areas will be considered. Tenderer to submit full details regarding past experience of execution of subsurface grouting in dolomitic areas.

Tenderer to indicate all past experience with particular reference to previous work (give project/site name) for the Department of Public Works, Department of Mineral and Energy Affairs: Geological Survey and individual Consultants.

PE 2 EQUIPMENT

Grouting equipment shall comprise of the following:

PE 2.1 Mobile / Moveable Pumping Units

A mobile concrete pump/pumping truck with 20 m^3 pump capacity per hour, equipped with suitable hoses and connectors for the required pumping pressures. The pump shall be equipped with suitable, calibrated (calibration certificate required) pressure gauges to record pumping pressures up to 1,5 MPa. The Contractor shall provide sufficient personnel as required to set-up equipment and execute grouting.

Tenderer shall submit a Safety Certificate issued by the manufacturer or SANS/ISO accredited firm for the complete pump unit.

PE 2.2 Grout Viscosity Measuring Instruments

The Contractor needs to provide an appropriate flow meter on the site for the duration of the Contract.

PE 3 ALTERNATIVE EQUIPMENT

The Tenderer needs to submit details of alternative equipment of similar nature available to him. Furthermore, he shall state the down time duration of replacement, in the event of equipment on site becoming unserviceable or experiencing major mechanical failure. Maximum of 4 hours down time will be allowed for minor mechanical repairs/failures per 40 hours of grouting.

PE 4 CONTRACTOR'S SUPERINTENDENCE

No work shall be executed unless supervised by a Suitable Representative of the Contractor that shall be made known, in writing, to the Engineer for his approval prior to commencement of the work.

PE 5 SETTING OUT OF THE WORKS

The Engineer shall determine the grouting depth ranges of each borehole.

PE 6 PRIORITY OF GROUTING SEQUENCE

The Engineer reserves the right to determine priorities regarding the sequence of grouting. The Contractor shall receive a grouting sequence before commencing grouting. No deviation from aforementioned grouting sequence shall be allowed unless an instruction to do so is issued by the Engineer.

PE 7 STANDING TIME

No provision or claims for standing time during the execution of grouting shall be heard, allowed, or paid for. In the event of insufficient information to continue grouting operation, due to lack of information or uncertainty regarding grouting sequence or depth, the Contractor shall inform the Engineer thereof before commencing grouting.

PE 8 LOCATION, PROTECTION AND DAMAGES TO EXISTING SERVICES

The Engineer shall furnish the Contractor with the location and routes of sub surface services within an accuracy of ± 5 m. Repair of damages to under/above ground services shall be for the account of the Contractor if the position of such services were made known to the Contractor or indicated by the Engineer. All damages to be reported to the Engineer within 1(one) hour of occurrence. The Contractor needs to submit a full damage report within 24 hours.

PE 9 SITE ESTABLISHMENT AND SETTING UP OF GROUTING EQUIPMENT

PE 9.1 Site Establishment

Site establishment shall cover the provision of the grouting equipment, previously described, and personnel on the site ready to commence setting up of equipment for any number of boreholes to be grouted.

The rate shall cover all cost to provide, maintain in working order and remove equipment from the site for the grouting phase. The site establishment shall be paid once only and no claims for standing time shall be heard or paid for.

Unit rate: Sum

PE 9.2 Setting Up of Grouting Equipment at Each Hole

The Contractor shall provide sufficient personnel as required to set-up equipment at each borehole to be grouted. After completion of grouting at a particular borehole all grout spilled on the surface shall be removed. Each borehole shall be defined as one set-up station irrespective of the number of grouting stages to be executed

Set-up rates shall include all costs to set-up the equipment, attaching of reusable couplings to grout pipes and decommissioning it, movement to next hole and clearing the site of the completed borehole.

Unit rate: no

PE10 GROUTING

PE 10.1 Depth of Grouting

No rate provision shall be made for grouting at different depths. The maximum grouting depth beneath normal ground level is less than 60 meters.

PE 10.2 Grout Classification / Specification

Grout of a particular borehole shall comprise of one of the mixes as described below. Ordering/batching quantities shall be continuous. The grout of each grouting phase per set- up shall be supplied and pumped continuously. The grout provided shall be free of stones, lumps, foreign soils or any other debris. In the event of premature choking of the grout pipe as a result of negligence on the part of the Contractor, the Contractor shall be ordered to re-drill and equip the hole at own expense.

The consistency/viscosity of the grout mixture must not exceed 400 mm on the Colcrete Flow metre and if possible be limited to 350 mm. Consistency measurement must be recorded at intervals of 12m3 and supplied to the Engineer. The flow meter shall be on the site at all times. The Contractor shall provide sufficient water on the site to correct grout slump requirements if needed.

The boreholes must be pumped to a pressure not exceeding 15% of the overburden pressure of the material that covers the cavity. Overburden pressure shall be calculated with material properties taken as that of loose sand. The calculation must be approved by a competent engineering geologist and the Departmental Dolomite Risk manager.

Special requirement: Mining slimes may not be used

PE 10.3 Grout Types to be Supplied as Follow

Grout type 1: 1,0-2,0 MPa/70:30 OPC:FA self-compacting concrete utilizing a mixture of crusher- and filler sand.
Grout type 2: 20:1 filler sand: cement
Grout type 3: 50 kg:1m3 Cement: Soil. (Soil to be salty sand with P.I. not exceeding 14.

The rate shall cover supply, handling, slump rectification, continuous delivery and pumping of grout as per specified type, to required depths and pressure as well as reporting. It also includes the excavation, loading and transport of any material from excavations on site.

Grout type 1:	1,0-2,0 MPa / 70:30 OPC:FA concrete.	Unit rate: m³
Grout type 2:	20:1 filler sand: cement	Unit rate: m³
Grout type 3:	50 kg:1m3 Cement: Soil	Unit rate: m³

PE 10.4 Grouting of Abandoned Pipes

This section deals with the grouting of subsurface cavities and engineering services with a pumpable concrete or cement/sand or cement/soil mixture. Work shall comprise of the pumping of grout mix directly from grout mixer via flexible piping attached to down-the-hole steel piping lowered to a depth as indicated by the Engineer into boreholes or set-up stations for services. Execution of each pumping operation shall be continuous.

Grout type: Soil-cement Unit rate: m³

Soil as specified mixed with 6% to 10% OPC and with water to have a slump of between 100mm and 150mm and 28 day strength of 2MPa
minimum.

PE 11 DOWN-THE- HOLE GROUT PIPES

The grout pipes shall consist of 50 mm high-pressure seamless steel pipes, to suit the required pumping pressures, lowered to the desired depth into the borehole. The surface end shall be provided with a collar or crossbar to prevent the pipe from slipping into the borehole as well as a reusable coupling to fit that of the pumping unit

.

The rate shall cover supply, insertion, anchoring to the surface, fitting and removal of the coupling unit.

Unit rate: m

PE 12 SPECIAL SAFETY REQUIREMENTS

Personnel executing grouting are to be strapped into harnesses and safety ropes secured away from the cavity/borehole.

Personnel shall be informed of the hazardous conditions pertaining to this type of work (Contractor to keep records of information sessions) and be made aware to report any:

a. Surface cracks
b. Cavities (irrespective of size)
c. Any ground movement

Should any of the above occur or are noticed, stop work immediately and clear the site of all personnel until the Engineer inspects the site.

PF PARTICULAR SPECIFICATION: BUILDING WORK

PF 1 SCOPE OF WORK

This section of the Specifications deals specifically with all the building work associated with the works.

Concrete work, steelwork, cladding, pipe laying, mechanical and electrical equipment, etc. forming part of or to be housed in a building erected in terms of this specification shall conform to the requirements of the relevant standardized or particular specifications referred to in the Project Specification.

PF 2 INTERPRETATIONS

The relevant SANS 1200 Standardized Specifications such as Site Clearance, Earthworks, Earthworks (pipe trenches), Concrete (structural), Fabricated steel works, Mechanical works, Electrical Works, Low pressure pipelines, Bedding (pipes), Sewers and Stormwater drainage shall also apply to the work under this section.

PF 3 MATERIALS

All materials used for the Building Work shall, where such mark has been awarded for a specific type of material, bear the SANS mark.

PF 3.1 Brick and Plasterwork

Cement, sand and water shall conform to the requirements of SANS 1200 G - Concrete.

Unless otherwise described, cement mortar shall be composed of six parts by volume of sand to one part by volume of cement. The materials are to be mixed dry until the mixture is of a uniform colour and then clean water is to be added gradually through a fine rose and the mixture turned over until the ingredients are thoroughly incorporated.

Cement mortar must be mixed in small quantities and must be used within one hour of mixing, as the use of cement mortar that has commenced to set will not be permitted.

Plaster on concrete ceilings, beams, columns etc. shall be mixed one part cement to three parts sand.

Bricks shall be of the best quality, sound, hard burnt, pressed bricks or in the absence of clay bricks, concrete bricks, even in size and shape and equal to a sample submitted to and approved by the Engineer prior to commencement of work.

Clay bricks shall conform with the requirements of SANS 227 and concrete bricks to SANS 987.

Damp proof courses, unless otherwise described, shall be an asphaltic damp proof course with a base of fibre felt, and complying with the requirements of SANS 248 Horizontal Damp Proof Courses, and with a mass of 3,25 kg/m² or a plastic damp proof course of 15 micron thickness as Type B, complying with the requirements of SANS 952.

PF 3.3 Paintwork

PF 3.3.1 Primers

Plastered surfaces must be cleaned down and have one coat alkali resisting primer of an approved brand applied in strict accordance with the manufacturer's instructions, before any undercoats are applied.
Galvanised metal surfaces must be treated with one coat Metal Etch Primer complying with the requirements of SANS 723.

Steel surfaces must be treated with one coat Type Zinc Chromate Primer complying with the requirements of SANS 679.

Steel windows and doors and steel door frames, before being built in, must have all loose primer together with all rust spots, dirt, etc. removed and be treated with one coat red oxide or zinc chromate primer complying with the requirements of SANS 909.

Wood surfaces to receive paint finish must be cleaned down, all knots treated with knotting and be primed with Type I Wood Primer externally and Type III Wood Primer internally, both complying with the requirements of SANS 678.

PF 3.3.2 Paints

Emulsion paint for interior use must be Grade I Emulsion Paint complying with the requirements of SANS 663. Emulsion paint for exterior use must be of the Synthetic Polymer Base Type complying with the requirements of SANS 634.

High Gloss Enamel Paint Shall be used on all surfaces other than specified above. High Gloss enamel paint must be Grade I paint complying with the requirements of SANS 630 for decorative High Gloss Enamel Paints with a Non-Aqueous Solvent Base, for Interior and Exterior use.

Undercoats for paints, except Emulsion paints, must be Type I undercoat Paint complying with the requirements of SANS 681.

PF 3.4 Doors, Windows and Glazing

PF 3.4.1 Doors

Unless indicated otherwise on drawings, all doors and door frames shall be of solid hardwood. Frames shall be fitted with suitable tie bars and braces at bottom, and lugs for building in, three to each jamb of frames without fanlights and four to each jamb of frames with fanlights. All doors shall be provided with locks to the requirements of SANS 4 and each lock shall be provided with a duplicate key.

PF 3.4.2 Windows

Steel windows must be of approved manufacture and design, constructed of rolled mild steel sections, properly mitred and welded at angles with welding cleaned off smooth on all faces and complying with the requirements of SANS 727. Window types and sizes shall be as specified on the drawings.

PF 3.4.3 Glazing

Sheeting glass for glazing, unless otherwise specified, must be flat drawn clear glass of the thicknesses indicated below:

For panes not exceeding 0,65 m2 : 3 mm

For panes exceeding 0,65 m2 and not exceeding 1,5 m^2 : 4 mm

PF 3.5 Tiling

PF 3.5.1 Adhesives and Grouts

a) Wall adhesive

A grey, cement-based thin bed, wall tile powder adhesive for fixing tiles to walls mixed with a bonding agent such as 'Tylon - Bond It'.

b) Floor adhesive

A grey, cement-based thick bed, floor tile powder adhesive for fixing heavy tiles to floors or walls.

c) Wall grout

A cement-based, plasticized grouting compound for wall tile installation.

d) Bonding agent

A latex modified for use with adhesives and grouts to improve water resistance.

e) Silicone sealant

A silicone-based sealant of nearest approximate colour to tile, used to seal the corners of permanently wet areas and expansion joints (made at consistent interval positions) on large tiled surfaces.

PF 3.5.2 Tiles

Tiles shall be of first grade quality glazed ceramic tiles, white in colour, a maximum size of 160 mm square, of a maximum thickness of 5 mm, unless otherwise specified.

PF 4 PLANT

Plant, equipment, tools, scaffolding, etc. utilised in building work shall be of suitable capacity, condition and design to ensure the satisfactory and timeous completion of the Works within the specified period and in terms of these specifications and good building practices.

Only registered artisans (e.g. plumbers, electricians, etc.) shall be employed on any work where this is compulsory building practice.

PF 5 CONSTRUCTION

PF 5.1 Brick- and Plasterwork

PF 5.1.1 Normal Brick Walls

Brickwork must be built in stretcher bond. No false headers are to be used and none but whole bricks except where legitimately required to form bond. The bricks are to be well wetted (saturated in hot weather) with water before being laid and the course of bricks last laid is to be well wetted before bedding fresh bricks upon it. All perpends and angles are to be kept plumb. The brickwork is to have the joints flushed up at every course solid throughout the whole width of the course, and each course is to be laid on a solid bed of mortar. Pointing is to be done as the work proceeds.

The joints of all walls to be plastered are to be raked out 15 mm as the work proceeds to form a key for plaster or screed. All walls are to be built up in regular and horizontal courses and carried out so that no part built is more than 1.2 m higher than any adjoining walls. Mortar beds generally are not to exceed 12 mm thickness.

PF 5.1.2 Face brick walls

In all faced brickwork the bond must be set out on the first level course of brickwork, at floor level internally and two courses below ground level externally. The bond, if necessary, is to be broken in the centre of panels under windows or to piers between windows. All perpends must be kept true and all courses must be built to gauge rods. Facings must be carefully protected from damage, mortar droppings, paint splashes, etc. during the whole period of the Contract and, on completion, they must be thoroughly cleaned down and left perfect. The practice of oiling facings on completion will not be allowed.

PF 5.1.3 Reinforced Brick Lintels

Brick lintels are to be built of normal, sound, well burnt, good quality building bricks, similar to the facings where exposed, properly bonded longitudinally and bedded and pointed in cement mortar as described. Special care must be taken to ensure solid bedding, particularly where the reinforcement occurs.

The lintels are to be reinforced with straight continuous mild steel rods of the size and number scheduled. The rods must each extend 300 mm on each side of the opening and are to be evenly spaced across its thickness in the first horizontal joint above the soffit.

Brick lintels in cavity walls must have all rods placed below the solid sections of the walls, excepting for those rods specifically scheduled to occur below the cavity.

Where two or more openings are less than 665 mm apart, the lintel shall be continuous over all such openings and the dividing piers, plus 300 mm bearing at each extreme end as before, shall have such height and reinforcement as scheduled for widest opening spanned.

Span in mm	Min. height of lintels above soffit course, in brick courses	Reinforcement per half brick thickness of wall above for solid walls	
		No. of Rods	Dia (mm)
600	2	1	6
900	3	2	6
1200	3	2	6
1500	4	3	6
1800	4	3	6
2400	6	3	6

In addition to any reinforcing specified in the table above one layer of brick reinforcing shall be placed at every alternate brick course above the lintel. The brick reinforcing thus placed shall extend at least 300 mm on each side of the opening.

All brick lintels are to be supported by two 114 x 38 timber bearers (on edge) for a duration of 7 days. Extreme care shall be taken beforehand to ensure a level and straight support.

PF 5.1.4 Damp proof courses

The sheeting is to be cut into strips of the required width and laid on all foundation walls to the full thickness of the walls and without any longitudinal joints. At ends, angles and intersections the sheeting must be lapped 150 mm and sealed.

Under all window sills exposed to the weather, the sheeting must be laid on the brickwork in the first joint immediately below the sill and turned up with an easy bend and tucked into window frame.

Over reinforced brick lintels exposed to the weather, the sheeting must be laid to form damp proof course as detailed above for solid walls and cavity walls.

PF 5.1.5 Reinforcing in walls

a. Brick Walls

Reinforcing (brickforce) of an approved manufacture shall be placed on every fourth course in all brick walls. The following reinforcing shall be used where applicable:

i.	For halfbrick and cavity walls (110mm)	:	75mm wide reinforcing mesh
ii.	For one-brick walls (230mm)	:	150mm wide reinforcing mesh

b. Concrete Block Walls

Reinforcing (brickforce) of an approved manufacture shall be placed on every second course in all concrete block walls. The following reinforcing shall be used where applicable:

i.	For 90mm Block	:	60mm wide reinforcing mesh
ii.	For 140mm Block	:	110mm wide reinforcing mesh
iii.	For 190mm Block	:	160mm wide reinforcing mesh

PF 5.1.6 Plaster work

All chases must be cut and electrical conduiting and boxes fixed before any plastering is done. On no account will chasing be allowed in finished plaster work, and if such chasing is necessary, the entire wall surface must be hacked off and re-plastered.

Except where otherwise described, all external plaster is to be finished with a wooden float and all internal plaster is to be finished with steel trowel, all to perfectly true and even surfaces, free from tool marks and other defects on completion.

All finished surfaces are to be protected from injury. All joints in brickwork are to be well raked out, all surfaces, brickwork and concrete, to be plastered must be brushed down to remove all dirt and dust and be thoroughly wetted directly before plastering. Concrete surfaces must be roughened or hacked as necessary to give a proper key for plaster. The surfaces must then be slashed with coarse cement grout before plastering is commenced. The surfaces of all internal plaster must be steel troweled to a smooth even and true finish. External plaster must be finished to a true and even surface with wood float. Plaster must be returned into reveals and soffit of openings and all angles and edges must be true and straight. All plaster surfaces must be free from blemish and any cracks, blisters, or other defects must be cut out and made good and the whole left perfect at completion. Plaster on walls must be not less than 12 mm or more than 20 mm in thickness, and plaster on concrete work must be not less than 10 mm or more than 15 mm in thickness, except where specifically otherwise described.

PF 5.1.7 Slip joints

Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and steel trowelling smooth the bearing surfaces of brickwork with 3:1 mortar and covering the bearing surface before concrete is cast with 2 layers of 0,500 mm (five hundred micron) black general purpose sheeting membrane.

The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 12 mm polystyrene placed vertically against the brickwork before the concrete is cast.

PF 5.1.8 Beam filling

Unless otherwise specified, beam filling shall be half brick thick, built in cement mortar, cut in between roof timbers and carried hard up to underside of roof covering and flushed up in mortar with a groove formed between covering and mortar. Care shall be taken to protect cladded surfaces from mortar, prior to beam filling.

PF 5.3 Paintwork

All surfaces not being painted, such as face brickwork, sills, floors and stained woodwork, must be covered up and protected against paint and distemper sports before any painting is commenced. All floors must be swept clean and walls dusted down before any paintwork is commenced and no sweeping or dusting must be done while painting is in progress.

All plastered walls' ceiling and similar surfaces must be perfectly dry and in a fit state to receive the finishing, before the work is put in hand.

All coats of paints, etc. must be thoroughly dry before subsequent coats are applied, and rubbed down where necessary.

All work must be finished to colours approved by the Engineer.

The tints of undercoats must approximate those of the finishing colour and in order to indicate the number of coats applied and to avoid misses when applying a succeeding coat a slight difference shall be made in the tint of each coat.

The Contractor must provide all necessary dust sheets, covers, etc., and shall exercise all necessary care to prevent marking the surfaces of joinery, walls, floors, glass, electrical fittings, etc., and must keep all parts of the works perfectly clean and free at all times from spotting, accumulation of rubbish, debris or dirt arising from the painting operations. Any surface disfigured or otherwise damaged must be completely renovated or replaced as necessary, by the Contractor at his own expense. The premises must be left clean and fit for occupation at the completion of the work.

PF 5.4 Floor and roof slab Finishes

Where a floated concrete floor finish is specified on the drawings, the requirements of SANS 1200G or GA, whichever is relevant, shall apply.

Floor and roof slabs shall be constructed to line and level as indicated on the drawings.

PF 6 TOLERANCES

Where tolerances are not specified in the clauses above those generally accepted as re-presenting good workmanship in the building trades shall apply.

PF 7 TESTING

The Engineer reserves the right to order any tests, whether at place of manufacture or on site, necessary to evaluate the quality of the work and to ensure the finished building conforms to all the specified requirements.

PF 8 FEATURES REQUIRING SPECIAL ATTENTION

PF 8.1 Formed Openings in Brickwork

All formed openings in brickwork shall be plastered on all faces internal to the opening, true to line and level with finished minimum internal dimensions as indicated on the plans.

PF 9 MEASUREMENT AND PAYMENT

PF 9.1 Schedule Items

Brickwork, if measured as a separate item, shall be measured in square metre of the nett brick-walled area (with the wall width and type of brick-finish, indicated). No deductions will be made for small openings such as air bricks, etc.

PF 9.1.1 Brickwork of Clay Bricks

ADD THE FOLLOWING PAYMENT ITEM:

Item: Construct brickwork of clay brick in Class II mortar for thickness:

a) 110mm
b) 230mm
c) 345mm Unit : m²

The rate shall cover the supply and construction of a clay brick wall as per specification and detail drawings and shall further include all mortar, bond and ties, and finishing.

PF 9.1.2 Brickwork of Concrete Blocks

ADD THE FOLLOWING PAYMENT ITEM:

Item: Construct brickwork of concrete block in Class II mortar for thickness:

a) 140mm
b) 190mm
c) 290mm Unit : m²

The rate shall cover the supply and construction of a brick/block wall as per specification and detail drawings and shall further include all mortar, bond and ties, and finishing.

The tendered price per square metre of brickwork shall include also for the following:

a) Brick and block forcing
b) Reinforcing of lintels
c) Miscellaneous items built into brickwork shown on the drawings such as air bricks.

PF 9.1.3 Wall, ceiling, roof and floor finishes

Cement plaster on walls and ceilings, roof screeds, floor screeds, paint and any other finish described or specified, shall if measured as separate item be measured in square metre of the nett surface area. No deductions shall be made for small openings nor shall additions be made for small protrusions and reveals. No separate payment shall be made for the processes involved and material supplied for the complete painting of all fixtures and fittings, as

specified herein and the costs thereof shall be included in the tendered price for the supply, manufacturing and erection of all such items to be erected.

The surface finish shall match the existing in texture, pattern and colour.

PF 9.1.4 Miscellaneous

a) Doors and windows shall be measured per unit of door or window complete with door frame, lock keys, glazing, painting, etc., for each type and size of door or window or as a lump sum payment for all doors and windows included in the door and window schedule of the Works.

   Rates tendered for doors and windows shall be included for the burglar proofing there off. Burglar proofing shall be welded unto the steel frame of all windows and doors. The minimum thickness of any solid burglar proofing bar shall be 12 mm and the minimum thickness of any tubing member shall be at least 2.5 mm.

b) Other items of building work, fixtures and fittings, shall be measured and paid for in the units of measurement listed in the Schedule of Quantities.

   The tendered rate shall be for the supply, erection/construction and commissioning of the item. The rates shall include for all plant, material, labour and other related costs.

PF 9.1.5 Services

a) Reticulation of services shall be measured per lump sum. The tendered rate for the specified service shall include for the supply, erection/construction, installation and commissioning of the services/system as indicated on the drawings. The tendered rate shall include for all fittings, specials, etc. The rates shall include for all plant, material, labour and other related costs.

   The distribution board shall have ample capacity to be extended for future extensions to the electrical reticulation of the building. The distribution board shall have a additional 50 A circuit breaker to cater for the connection of the luminaire lighting system to be installed by on a nominated sub-contract.

b) The installation of the luminaire lighting system in the hall area shall be done by a specialist nominated sub-contractor.

c) The lump sum tendered under for the connection of services shall include all costs incurred for the installation and commissioning of the mentioned services under this item. The tendered lump sum shall include for all fees and duties payable to the Local Authority/Council or Bulk Service Provider for the application and connection of the service to the municipal service network. All connections to the municipal service network shall be to the specification and regulation of the relevant Local Authority.

PO PARTICULAR SPECIFICATION: OCCUPATIONAL HEALTH AND SAFETY

SPECIFICATION IN TERMS OF THE CONSTRUCTION REGULATIONS (2014) UNDER THE OCCUPATIONAL HEALTH AND SAFETY ACT, NO 85 OF 1993

PO 1 BACKGROUND

In terms of the Construction Regulations of 7 February 2014, Section 5 (1) under the Occupational Health and Safety Act, No. 85 of 1993, the Client is required to compile a Health & Safety Specification for the intended project and provide such specification to any prospective tenderer.

These Health and Safety Specifications will be revised from time to time in accordance with changing circumstances on the construction site or by mutual agreement between the Client and the Principal Contractor.

The Client's further duties are as prescribed in Section 5 of The Construction Regulations, February 2014.

The Principal Contractor will have to prove that they comply with the Occupational Health & Safety Act – Act 85 of 1993 and Regulations as well as all the incorporated safety standards, when appointed, by proving to the appointed Health and Safety Agent that they have a documentation management system to deal with all the aspects of the requirements of the Act, Regulations and Safety Standards. The Safety Agent representative will take photos of all the documents, personal records of all employees will only be taken one as example and all the detail will be expected that the Principal Contractor keep record, these photo records will serve as a consolidation which can be submitted to the client at the end of the project. These photo records of the documents will be summarized by the Agent on a one page document "Contractors Matrix" which will indicate the compliance status of the responsibilities of the Principal Contractor and all their appointed Contractors (Sub-Contractors) once a month. The audit results get summarised once a month for all the Projects which The Safety Agent are involved with and we will publish these results of all the Projects to all the Projects. Any non-compliance can result that a specific activity of the Contractor get stopped and that stoppage will be for the account of the Principal Contractor or the appointed Contractor. The Health and Safety Agent will do audits on site at agreed intervals to determine whether the Principal Contractor and the appointed Contractors do comply with the Act, Regulations and Safety Standards. It is expected from the Principal Contractor and appointed Contractors to supply to their employees all the required personal protective equipment and clothing which is required for the applicable task. It is further required that the Principal Contractor appoint a full time Health & Safety Representative/Safety Officer (Principal Building Contractor only – multi discipline Contractor) for the Project. See the specification in the special conditions. Each appointed Contractor under the Principal Contractor, whether they are selected, nominated or domestic Sub Contractors they must all have a Health & Safety Representative and this person will be responsible to manage their detail Health & Safety program. See attached a copy of the Contractor's matrix.

PO 2 SCOPE

Development of a Health & Safety Specification that addresses all aspects of occupational health and safety as affected by the **PRETORIA SWARTKOP AIR FORCE BASE: DOLOMITE RISK MANAGEMENT: UPGRADING OF CIVIL ENGINEERING SERVICES: COMPLETION CONTRACT**

PO 3 OH&S MANAGEMENT

PO 3.1: List special conditions on site:

(The special conditions on site are items that need special attention or items that are agreed upon between the Client and Principal Contractor or principal contactor and Contractor before the start of the construction activities, for example, underground services, overhead power lines, site access control (fencing), etc.)

3.1. The Principal Contractor must at all times have supervision on site for all construction activities at that point in time, which include work after hours and weekends.

3.2. The Principal Contractor must have a Risk Assessment which is compiled based on their methodology and processes, for each of the items as listed in the Baseline Risk Assessment, in order to reduce the high rating of the activity. The Principal Contractor must ensure that all their activities must be addressed in site and task specific risk assessments that must be available in their Health and Safety File. The Risk Review and Monitor Plan must also be available in the Health and Safety File.

3.3. The specific requirements included in the tender documentation from the Airforce Base must be complied with at all times and must be considered on a daily bases when planning the daily work to be done.

3.4. The Principal Contractor must ensure that the permitted working hours of 07h00 to 17h00 weekdays only of the Airforce Base is adhered to at all times and that the events planned by the Airforce Base is accommodated by the Principal Contractor if and when notified of such an event. Any working ours that fall outside this scope must be applied for by the contractor.

3.5. Access to the base is through the security gates and persons entering and exiting the premises will be required to present a valid South African identification document each time. Regular visitors to site will be issued with an identity card by the base.

3.6. The Principal Contractor must install hoarding as per the Drawing as issued by the Principal Agent, or as deemed required by the building / construction activity (to isolate members of public from construction activity). The detail of which the hoarding will be constructed will be agreed as the Construction activities require from time to time, but must be of solid material used to separate construction activities, and should be of a minimum height of 1.8 metres.

3.7. The Principal Contractor must keep all construction activities/material/equipment within the barricaded/hoarded area. The hoarding must be maintained throughout the Project. The required No Entry signage and construction signage must also be displayed on the hoarding, and especially at the entrance gates. And all visitors to site must be required to sign in at the entrance gates, before entering the site.

3.8. The Principal Contractor must do site establishment as indicated by the principal agent. These areas must be controlled at all times, no members of public allowed within laydown areas.

3.9. All construction personnel will be required to wear similar brightly coloured uniform of which the colour will be agreed upon between the client and contractor.

3.10. Temporary power may be obtained from the nearest hanger or building and will be pointed out to the contractor by the principal agent, the temporary electrical installations must be done by a registered electrical contractor and a COC must be issued for each temporary electrical installation in use.

3.11. The Principal Contractor must not allow any informal traders in the construction area, no food stalls or similar operation may be allowed within the hoarded area of the construction site.

3.12. The Principal Contractor must have, as a first activity, chemical toilets in the site establishment to ensure that all construction employees have the facility from the outset.

3.13. The Principal Contractor must have an Employee Facilities Inspector appointed in writing, and this person must be required to complete a weekly facilities Checklist.

3.14. The Principal Contractor must control excessive dust as far as possible.

3.15. The Principal Contractor must ensure that if any construction vehicle, which park in the street, for delivering materials and/or lifting operations by mobile cranes and/or concrete pumping operations get done in such a manner that the members of public are not exposed to any of the construction activities. There must be as a minimum moveable hoarding (for example the type that get used at sports stadiums for crowd control) it must further have cones with a flagmen on both sides.

3.16. The Principal Contractor must appoint a Stacking & Storage Supervisor in writing, and a weekly stacking & storage Checklist must be completed by the appointed person.

3.17. The stacking of brick pallets must be done in a safe and secured manner, brick stacks required to be double stacked, must be wrapped or tied at all times, especially if near public areas.

3.18. Not more than two pallets of bricks may be stacked on top of each other.

3.19. The Principal Contractor / sub-Contractors to comply with the National Road Traffic Act 93 of 1996 at all times when carrying out their disciplines on roads, intersections, cross overs etc.

3.20. The Principal Contractor must ensure that the construction vehicles get cleaned off on the sides, between double wheels and the back to prevent loose soil and stones falling from the truck into the public road while driving out of the site.

3.21. The Principal Contractor must despite the cleaning of the trucks ensure that there is at all times someone to clean the public road surface from the soil that might be brought onto the road by the wheels of the construction vehicles.

3.22. The Principal Contractor must ensure that they communicate with their contractors and staff that the Airforce employees and vehicles have right of way and that the traffic management rules of the base must be complied with at all times.

3.23. No plant or machinery may be allowed near the runways unless authorised to do so by the Engineer in writing. The minimum safety distance from the runway must be kept at all times.

3.24. The Principal Contractor must ensure that rubble and debris is cleaned constantly at each storm water grid inlets and catch pits effected by the construction activities.

3.25. Trained and appointed flagman must be positioned at each public area that will be effected by construction activities on the roadside.

3.26. The mandatory road and construction warning signage must be displayed at all times at the lane restriction and lane closure areas, these areas must be closed off as per the Engineer instructions but should at least be done with barriers and delineators.

3.27. A detailed traffic management plan must be drawn up for any lane closures or restrictions that may be done and must be submitted to the Engineer and The Safety Agent.

3.28. The Principal Contractor must take note that no hotwork can be done on site without a hotwork permit.

3.29. Sufficient firefighting equipment must be available at the immediate hotwork area. All Contractors doing hotwork must have their own firefighting equipment.

3.30. The Fire Equipment Inspector must be appointed in writing with a training certificate.

3.31. A welding supervisor in the case of hotwork must be appointed in writing with a proof of competency.

3.32. The Principal Contractor must ensure that all Health & Safety files are updated for the month during the first week of the month.

3.33. The Principal Contractor must have a daily inspection record for all the fall arrest equipment on site and the barricading of all fall dangers. A fall arrest equipment inspector must be appointed in writing to inspect all fall arrest equipment before use.

3.34. The Principal Contractor must submit to The Safety Agent the detail of the type of temporary work they intend to use, and proof of the competency of the temporary work supervisor, prior to any temporary work activities starting on site. All temporary work must be inspected on a daily basis and must be recorded in a register, until the temporary work and support work has been removed.

3.35. The Principal Contractor must have a competent Temporary Works Designer, with the required technical qualifications appointed. This person must issue the design of the temporary works to the contracting team, and after the contracting team have erected it, do an inspection to see whether the design was correctly erected.

3.36. The Principal Contractor must ensure that if the Temporary Works Designer cannot inspect the Temporary Works, a competent person appointed as Temporary Works Inspector, must be appointed in writing, and conduct an inspection to see whether the design was correctly erected.

3.37. The Principal Contractor to ensure that every employee on site has a valid, certified copy of their South African ID and contact information of next of kin, and proof of a medical fitness certificate, in the form of an Annexure 3 issued by a registered Occupational Practitioner. Any employee found on site without the correct documentation will be asked to leave the premises immediately.

3.38. All services like water, electricity and gas will be pointed to the Principal Contractor by the professional team appointed by the Client as far as reasonably possible. There must be a documented proof that the services for water, storm water, sewer, gas (if applicable) and electricity was terminated successfully. For the gas and electricity there must be a Certificate of Compliance to say it was terminated.

3.39. The Principal Contractor must ensure that the appointed Contractors with 5 and more employees have a first aid box and that Contractors with 10 and more employees have a first aid box with at least one person on site with a first aid certificate.

3.40. The Principal Contractor should take note that they have to supply the Engineering office with a first aid box and PPE as specified in the tender documentation but should at least consist of safety helmets, rubber boots and reflective fests.

3.41. All excavations or fall risk positions must be barricaded/fenced with a solid material (for example scaffold tubing, not just plastic barricading) with the minimum height of 1 meter. All edge barricading used on site

must be of solid material, if scaffold tubing or similar method is being used, it must be installed that a knee and guard rail/hand rail is installed at the open edges. The scaffold tubing or similar material must also be securely fixed to the posts being used.

3.42. Accredited working at heights training, as noted in Construction Regulation 10(2)(c), is required for any employee performing a task from an unsafe platform or any elevated position, that is not safe or made safe with the use of a fall prevention system. All working at heights training must be in line with the applicable SAQA Unit Standard.

3.43. The Principal Contractor must ensure that at least 1 representative from each appointed Contractor attend at least one safety meeting per month chaired by the Principal Contractor. The Health and Safety Chairman from the Principal Contractor must be nominated and appointed in writing.

3.44. The Principal Contractor is responsible for the access / security control to the construction site and only persons with a unique identification, which they have received during the induction for the site, must be allowed into the site and this include the Client representative and the professional team. This induction must include as a minimum emergency procedures and what construction activities are currently on site, and how a person must identify and behave in order to not be exposed to this hazard. The Principal Contractor must however ensure that every person on site can be identified by means of a tag / access card or the construction company name on their overalls.

3.45. The Airforce Base may require security clearance investigations to be conducted on any number of persons or contractors at their discretion.

3.46. The Principal Contractor and all the Contractors are not allowed to burn or deposit any waste on site it is to be discarded to an approved dump site or a recycling facility.

3.47. The Principal Contractor will have a daily inspection record of excavations on site.

3.48. Any sudden changes in soil profiles or over excavations or cavities encountered must be reported to the engineer with immediate effect.

3.49. The Principal Contractor must take special note that the premises is located on known dolomitic strata and poses a high risk of sinkholes and dolines which are not marked on drawings.

3.50. Before employees enter an excavation, measures must be in place to sign off the excavation work to take place before access to the excavation can commence and this process must be done on a daily bases taking into account the ground conditions of the premises.

3.51. Berms must be constructed on either side of open excavations and trenches to prevent the flow of water during rainstorms.

3.52. The movement of plant and machinery on site and road traveling may not always be possible and this must be properly planned and large plant movement on site must be arranged in advance with the Engineer.

3.53. Contractors and employees who will be required to work in or around dolines and sinkholes are to be secured by means fall arrest equipment such as safety harnesses and lifeline systems secured away from the sinkholes or should be suspended in such a manner that the person will not fall into the sinkhole.

3.54. A detailed method statement and risk assessment regarding the work inside the sinkholes must be drawn up and must include a rescue plan and procedures in the event of earth movement or similar incident.

3.55. Surface cracks, cavities, ground movements or any sudden variation in soil profiles will grant that work must be stopped with immediate effect and notification submitted and reported to the Engineer for immediate inspection before any work can commence further.

3.56. Hand excavations must be done in a safe and secured manner and the possibility of underground services must be planned for and considered during hand excavations to ensure that health & safety of employees are not effected by undetected services.

3.57. The construction work to be done must be planned in such a manner that the emergency response areas of the base is not sealed off and obstructed by construction activities or material.

3.58. The air tests to be done on the pipes installed must be done in a safe and secured manner, a detailed method statement and risk assessment for the air test must be complied and submitted to the Engineer and The Safety Agent prior to the tests being carried out to ensure that the health & safety requirements for these tests are adhered to.

3.59. The Principal Contractor will have a daily inspection record of all scaffolding on site irrespective of the height of the scaffold, by a competent person appointed in writing.

3.60. The Principal Contractor must appoint a Housekeeping Supervisor and also ensure that all Contractors appoint their own Housekeeping Supervisors, to ensure that the Housekeeping on site is maintained on a daily basis. To ensure this each Contractor will be required to complete a weekly Housekeeping checklist.

3.61. The housekeeping conditions throughout the site must be maintained constantly to avoid any foreign object or debris from becoming congested in aircraft engines.

3.62. The principal contractor must ensure that no red and white danger tape or similar tape is used on this project.

3.63. Each Contractor is required to appoint a Risk Assessor, Incident Investigator and Fall Protection Plan Developer (if applicable), and each discipline must be appointed in writing, with a competency certificate in the Health and Safety file.

3.64. The Principal Contractor must appoint an Electrical Power Tool Inspector, and this person must be required to complete a monthly electrical power tool Checklist.

3.65. The Principal Contractor must appoint a Hazardous Chemical Substance Controller in writing, to control and manage the hazardous chemicals on site.

3.66. The Principal Contractor must take note that a Construction Work Permit Application for this Project will be submitted by the Health and Safety Agent. Once the Approved Permit is received, the Permit Number must be displayed at the entrance of the site.

3.67. The Principal Contractor must take note of the details below for the Local Department of Labour offices:

3.67.1. Contact person: Marelize Dorfling

3.67.2. Telephone number: 012 309 5008

3.67.3. E-mail address: marelize.dorfling@labour.gov.za

3.68. The Principal Contractor must inform The Safety Agent, on the same day, when the Department of Labour issue any written notices for a non-compliance on the site, and a copy of such notice must be forwarded, as soon as possible on the same day, to The Safety Agent. The Principal Contractor must not submit any reports to the Department of Labour unless verified by the Safety Agent.

3.69. The Principal Contractor and their appointed Contractors must take note that if it is found that an employee committed an unsafe act or caused an unsafe condition on site The Safety Agent will take action against the foreman/management/legal appointee responsible for this activity. The most likely action will be that The Safety Agent will instruct the foreman/management/legal appointee in question to stop that activity with immediate effect. It will not be tolerated that management allow unsafe conditions.

3.70. The Principal Contractor must appoint a full time Health & Safety Officer (registered with SACPCMP) to monitor the activity of the Principal Contractor as well as all the appointed Contractors. It is also required that each appointed Contractor, appoint a Health & Safety representative, irrespective of whether the Contractor employ twenty or less employees for this Project.

3.71. The Principal Contractor and all appointed Contractors must appoint an Explosive Actuated Fastening Device Operator with proof of competency if this equipment will be used on site.

3.72. The Principal Contractor and all appointed Contractors must appoint a Hand Tool Inspector, and this person must be required to complete a Hand Tool Checklist at least once a month.

3.73. The Principal Contractor and all appointed Contractors must appoint a Ladder Inspector, and this person must be required to complete a Ladder Checklist at least once a month.

3.74. A trained and certified banksman must be appointed in writing for any crane or similar operations required on site.

3.75. The Principal Contractor must ensure that where specialised rigging operations / intricate rigging is required, or where rigging of 5 tons or more must be done, a competent Rigger must be appointed in writing with the required qualifications.

3.76. The Principal Contractor must also ensure that a rigging study is compiled for any rigging to be done.

3.77. Site Emergency Evacuation Procedures must be compiled by the Principal Contractor and all employees and Contractors on site must be trained on the Emergency Procedures. This Procedure must be updated as and when needed. The Principal Contractor must also appoint in writing a competent Emergency Evacuation Coordinator.

3.78. An Emergency Evacuation Drill must be conducted at least once every six months. The applicable escape routes must be accessible at all times.

3.79. A security management procedure must also be complied by the principal contractor and must be enforced throughout the project on the site establishment and construction site areas.

3.80. The Principal Contractor must ensure that a close out report is issued to the Safety Agent within three working days after a Safety Agent report was issued to site.

3.81. In the event of a fatal incident it will be required that the Principal Contractor and all the appointed Contractors who can have an influence on the incident, that they hand in their Health & Safety files with immediate effect to the Safety Agent.

3.82. Site incident reporting procedures must be compiled and communicated with all employees on site.

3.83. The Principal Contractor must ensure that any Incident Investigation is reflected in a Report, and this Report should deal with the detail of the Incident under at least the four headings listed below:

3.83.1. History of the Incident - This will give a description of the project in general, the time and date, the injured persons' name, designation, ID number, description of the area, activities and the extent of the injuries the person incurred.

3.83.2. Applicable legislation - The investigator must list here in his/her opinion which specific Sections of the Act and Regulations as well as incorporated safety standards are applicable/relevant to the incident.

3.83.3. Evidence - The investigator must list here all the evidence which was taken to consider in the investigation. For example: photos, statements, documentation out of the Health and Safety File and drawings/sketches. This is an example of the types of evidence, but there may be more.

3.83.4. Conclusions - The investigator should compare the evidence with the applicable legislation and highlight where there was no compliance.

3.84. The Safety Agent will keep record of the Health & Safety documentation on the Contractor matrix to report on the legal requirements of site. The Contractor matrix has got an assessment with it and these assessments will be done on a monthly basis. The results of these matrix reports and the site notice reports will be combined on one summarised report per Client. This in practice will mean that the Safety Agent is involved on various Projects for the same Client / Developer, and it is for this Client / Developer which we will have a combined summary report.

Baseline Hazard Identification and Risk Assessment Register ©

1. Bulk Earthwork Projects

2. Methodology

3. HIRA

4. Risk Assessment

Configuration Management			
Prepared By	**Cairnmead Industrial Consultants (Pty) Ltd**	**Register Number**	**CIC 3126**
Approved By	**CPJ Lourens CHSM/480/2018**	**Revision**	**2018/02/20**
Issue Date	**2017/04/17**	**Project:**	**Swartkop Air Force Base: Completion Contract**

2. Methodology

Seriousness rating	Description
1	No injury or illness
2	First-aid treatment case, medical treatment case and temporary discomfort case
3	Medical mitigation case; occupational disease with non-permanent effect
4	Lost Time Injury. Occupational disease with permanent consequence e.g. hearing loss
5	Fatality (as a result of incident or occupational disease e.g. asbestosis)
6	Multiple fatalities or multiple permanent occupational diseases

Determine the likelihood that the event will occur	
Category	**Criteria**
E	• 99% probability, or • impact is occurring now, or • could occur within “days to weeks”
D	• >50% probability, or • balance of probability it will occur, or • could occur within “weeks to months”
C	• >20% probability, or • may occur shortly but a distinct probability it will not, or • could occur within “months to years”
B	• >5% probability, or • may occur but not anticipated, or • could occur in “years to decades”
A	• <5% probability • occurrence requires exceptional circumstances • only occurs as a “100-year event”

Plot consequence & likelihood in risk matrix to determine risk priority level

Seriousness						
	6	III	II	I	I	I
	5	III	II	II	I	I
	4	IV	III	II	I	I
	3	IV	III	II	II	I
	2	IV	IV	III	II	II
	1	IV	IV	III	III	III
		A	***B***	***C***	***D***	***E***
		Likelihood				

Evaluate the risk based on the level of risk determined, as well the effectiveness of the current risk controls

Priority	Risk ranking	Action required	Escalation
i	Very High	Immediate action required	Report to CEO and Client Agent.
ii	High	Strong mandatory action required	Report to Contracts manager and Client Agent.
Iii	Medium	Action required, possibly at administrative level	Report to Contracts manager.

iV	Low	Minor or no action required	No escalation required.

The organization shall **establish, implement and maintain a procedure(s)** for the on-going hazard identification, risk assessment, and determination of **necessary controls**.
The procedure(s) for hazard identification and risk assessment shall take into account:
a) routine and non-routine activities;
b) activities of all persons having access to the workplace (including contractors and visitors);
c) human behaviour, capabilities and other human factors;
d) identified hazards originating outside the workplace capable of adversely affecting the health and safety of persons under the control of the organization within the workplace;
e) hazards created in the vicinity of the workplace by work-related activities under the control of the organization;

NOTE 1 It may be more appropriate for such hazards to be assessed as an environmental aspect.

f) infrastructure, equipment and materials at the workplace, whether provided by the organization or others;
g) changes or proposed changes in the organization, its activities, or materials;
h) modifications to the OH&S management system, including temporary changes, and their impacts on operations, processes, and activities;
I) any applicable legal obligations relating to risk assessment and implementation of necessary controls;
j) the design of work areas, processes, installations, machinery/equipment, operating procedures and work organization, including their adaptation to human capabilities.
The organization's methodology for hazard identification and risk assessment shall:
a) be defined with respect to its scope, nature and timing to ensure it is proactive rather than reactive; and
b) provide for the identification, prioritization and documentation of risks, and the application of controls, as appropriate.
For the management of change, the organization shall identify the OH&S hazards and OH&S risks associated with changes in the organization, the OH&S management system, or its activities, prior to the introduction of such changes.
When determining controls, or considering changes to existing controls, consideration shall be given to reducing the risks according to the following hierarchy:

Hazard Identification, Risk Assessment and Controls

Before construction start, the Baseline Risk Assessment is a theoretical assessment before the construction start in order to highlight the foreseen hazards, but this is not intended to be seen as an absolute 100% of hazards that may occur.
The Principal Contractor or their appointed Contractor should take this and whatever hazards that may be presented, due to the unique process which get used to execute the specific construction activity. This Baseline Risk Assessment does not give any control measures because that need to be done with the applicable unique Risk Assessment by the Principal Contractor or their appointed Contractor. The risk rating is deliberately rated high because there is no controls in this and without the required controls the possibility of the potential risk are very high, as indicated.

No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 001	Temporary hoarding to separate public and construction work. • Existing boundary fences. • Barriers for lane restrictions	- The erector must follow the specific position as required. - When digging for fence poles, services can be damaged. - When posts get knocked in it can damage services.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H & S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 002	Security	- No security in place at entrances to construction site. - Unauthorized entry to site. - Theft of materials and equipment.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H & S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 003	Access control	- To prevent unauthorized entry into the construction area, beyond the area which was fenced off as per the Engineers drawing, from	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce	As far as possible have a picture which can be of benefit for illiterate readers	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations

		the gate which the contractor control up to the furthest point of the hoarded area. - Access control measures not in place at access gates. - Accessing site from unsafe areas. - Unauthorized entry onto site due to lack of access control measures. - Not adhering to the access requirements of the Air Force Base.	the high risk rating to within a lower controlled risk rating. Detailed Risk Assessment by Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times	when the detailed risk assessment is done.						(85 of 1993) and incorporated safety standards.
BLD 004	Induction & Medical certificate of fitness	- Employees entering site not being inducted. - Visitors entering site not being inducted / signing visitors' induction form. - Visitors not being provided with the necessary personal protective equipment. - Induction being conducted on employees without them being in possession of a valid medical certificate of fitness in the form of an Annexure 3. The medical must be conducted by a registered Occupational Health Practitioner. - Construction vehicles and mobile plant operators entering the site without being inducted. - Driver of delivery vehicles not made aware of the specific site conditions. - Employees being inducted without valid work permits / certified ID Copies.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 005	Site Clearing	- Use of unsafe mobile plant or machinery. - Damage of site fence due to site clearing operations. - Damage to existing services not marked or pointed out to the Principal Contractor. - Employees being struck by moving plant working in the area. - No dust control measures in place. - Removing tall trees unsafely. - Damage to neighboring properties. - Several construction vehicles and mobile plant operating in confined space area and unsafe / uncontrolled interaction with employees on site. - Construction vehicle and mobile plants reverse hooters not working. - Unsafe stockpiles of soil or other materials on site. - Unauthorized removal of indigenous & endangered fona & flora.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 006	Temporary water supply	- No proper water supply available on site. - Improper water connection causing water spillages on site. - Contaminated waste. - No drinkable water available for employees on site until temporary water supply is available.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 007	Temporary power supply	- No COC available for the temporary electrical connection used on site. - No weekly inspection done by competent person appointed in writing. - Temporary DB not installed in accordance to the legal requirements.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 008	Site establishment • Transporting containers / temporary offices to site. • Offloading containers / offices.	- Safety signs and notice boards not placed close to entrance of main gate. - Lay down areas not off sufficient size. - No toilets provided as per requirements. - Not informing employees and public what the site rules are. - Damaged / loose wires exposed at site offices. - Material handling can cause crush injuries and falling objects. - Incorrect placement / position of containers / site offices.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

	• Container / offices placement. • Demobilisation • Cleaning	- Tripping hazards / Fall risk	persons, the safe guarding of machinery and structures are assured at all times.							
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	L	Final Rating	
BLD 009	Employee facilities	- Insufficient employee facilities on site, causing employees to pollute the site. - Polluting the environment. - Facilities not being cleaned and maintained. - No changing facilities available for employees on site. - No canteen / dining / sheltered eating areas available for employees on site. - No inspections conducted and no checklist completed as per the Safety Agent Specification.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 010	Waste removal	- Trip, fall and stumble. - Bearers, stacks or palettes collapse. - Falling load can struck employees. - Scattered or protruding objects. - Incorrect PPE issued to workers. - Incorrect placing of rubble shoots. - Incorrect sorting of materials. - Insufficient bins allocated in designated, prominent areas on site for employees to make use of to throw their domestic waste in. - Employees burning waste on site. - Hazardous waste being removed from site as normal waste.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 011	Parking of vehicle in public road	- Damage to structures and equipment. - Injuries to people. - No trained flagman available at obstruction area. - No temporary road closure / lane restrictions warning signage displayed and installed.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated

		- No wayleave in place should lane restrictions / road closures occur. - No temporary / moveable hoarding in place. - No warning lights available in evenings. - No stop and go process in place should it be applicable.	The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.							safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 012	Exit / entry into the public roads	- Injuries to pedestrians / members of public. - Collision with public vehicles. - No points men / flagmen positioned at access gates. - No warning signage displayed at the access gates to site for vehicles turning. - No stop and go process in place should it be applicable.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 013	Surveying	- Wrong readings. - Access for surveyor to site being obstructed by material / plants. - Surveyor required to work close to unprotected openings / edges. - Surveyor not complying with site personal protective equipment requirements.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

BLD 014	Underground services and servitude	- Underground services not clearly identified can lead to damages of services during construction activities. - Services not pointed out to the contractor. - Termination of services not documented and certified.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 015	Excavations • Digging of excavations using plant and manual labour. • Working in and around excavations • Trenches	- Materials can fall onto employees due to dislodgement of earth or rock. - Unstable / loose material causes unsafe conditions. - Employees not able to enter or exit the excavation safely. - Employees being trapped inside excavation due to the collapse of the excavation. - Inappropriate placement of excavated materials, plant or other loads close to/on the edge of the excavation. - Employees being struck by moving plant working in and around the excavation. - Inadequate warning signs of deep excavations for employees in close vicinity. - The instability of the excavation due to persons or plant working adjacent to the excavation.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 016	Excavations • Digging of excavations using plant and manual labour.	- The presence of or possible inrush of water (example: ground water) and the control thereof. - Employees being exposed to hazardous atmosphere in an excavation including welding fumes, gases and arcs.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety

	• Working in and around excavations • Trenches • Working in and near sinkholes.	- Employees being exposed to hazardous chemicals that might be present in the soil where excavation work are being carried out. - Excavation work taking place underneath or close to overhead services (powerlines) and ground mounted services. - Employees being exposed to vibration and high noise levels. - The sides of the excavation is not adequately supported by means of shoring. - Shoring installed not of adequate design. - Previous disturbance of the ground including previous excavation or old sewer lines etc. - Excavation positioned close or nearby existing structures. - Employees being exposed to an airborne contaminant while working inside excavation. - Employees falling into excavation due to inadequate barricading. - The in-proper management of the interface with other works or trade activities. - Excavations not being inspected daily by the competent appointed Excavation inspector. - Excavation work close to existing services.	Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.							standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 017	Compaction • Compaction of excavations. • Compaction of bases. • Use of roller. • Use of compactor. • Working near sinkholes	- Checking the machine. - Injury especially to feet and hands from any moving parts. - Not holding the machine firmly when starting it. - Sides of excavation may collapse causing persons to fall or being struck by falling material. - Worker may be buried in soil. - Employee and operators being exposed to high noise levels. - Vibration of machines. - Dust. - Spillages due to refuelling of machinery. - Fire hazard.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 018	Backfilling	- Excavations not backfilled as soon as possible after excavation work is complete.	The Principal Contractor or their appointed Contractor	As far as possible have a picture which	N/A	H&S	6	E	6E	Occupational Health and

	• Layer works to roads. • Layer works to excavations.	- Not wearing personal protective equipment. - Sides of excavation may collapse causing person to fall into excavation / employees inside excavation being trapped / buried. - Worker may be buried in / under soil. - Collision of construction vehicles and mobile plant working in close proximity of each other / congested areas. - Possible injuries to employees when handling materials / equipment or plant.	should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	can be of benefit for illiterate readers when the detailed risk assessment is done.						Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 019	Working in or near live sewerage	- Employees not wearing correct personal protective equipment when there is danger of being exposed to raw sewerage. - Possibility of employees being exposed to methane gas. - Insufficient facilities available for employees to decontaminate after being exposed to sewerage. - Underground septic tanks not installed according to design and applicable regulations.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 020	Working in confined spaces	- Poisonous gas, fume or vapour present in confined space. - Lack of oxygen for employees working in confined space area. - The presence of flammable gasses in confined space can lead to fire or explosion. - Employees being exposed to high noise levels in confined space. - Employees being exposed to extreme temperatures / changes in temperature in confined space.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

		- Insufficient safe access for employees in and out of work area. - Risk of exposure to hazards associated with lack of adequate ventilation for activities in confined spaces.	persons, the safe guarding of machinery and structures are assured at all times.							
BLD 021	Shoring	- Temporary works / shoring not designed by appointed Designer. - Temporary works / shoring not being signed off by appointed Designer. - Temporary works / shoring not inspected daily by competent person. - Temporary works / shoring not inspected immediately after inclement weather. - Contractor using defective temporary works / shoring equipment. - Erection of temporary works / shoring structure done incorrectly. - Dismantling of temporary works / shoring structure done incorrectly. - Employees not being provided with safe access to enter / exit excavation while erecting / dismantling temporary works / shoring.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 022	Material levelling	- Employee may be run over by machines. - If plant is not visible from distance or there is an indication that it is in operation, may cause persons to be unaware of the machine until it is too late. - Falling load can struck employees. - Construction vehicles uncontrolled / unmanned could cause injuries to people, equipment and structures. - If stop blocks are not used under wheels of parked construction vehicles and mobile plant, vehicles could move uncontrolled and cause injuries or damages.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 023	Material & equipment handling • Receiving and off-loading and loading of	- Delivery vehicle driver not familiar with the site. - Driver not instructed on site rules. - Vehicle parking in unauthorized area. - Loads incorrectly/unsafely off loaded from vehicle.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and

	equipment and/or material	- Loads incorrectly loaded onto vehicle or stacked incorrectly. - No wayleave in place when offloading materials in public road. - Materials have moved on / inside truck or delivery vehicle making it unstable. - Overloading of vehicle. - Materials falling onto employee. - Employee handling materials sustaining hand injuries. - Materials offloaded in incorrect area/unsafe area.	lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	assessment is done.						incorporated safety standards.
BLD 024	External roadworks	- No warning signs displayed. - Signage not installed according to the drawing. - No trained flagman positioned at affected area. - Road closures not done in accordance to the legal requirements. - No wayleave in place for work to be done. - Operators speeding on the construction site / road area. - Employees not visible for operators / not wearing reflective vests / clothing. - Parking construction vehicles & mobile plant in dangerous / unauthorized area. - Not taking into account working in close proximity of overhead power lines or any other services. - No safe walkway created for pedestrians of required. - No delineators / warning lights in place, for clear visibility in evenings. - No warning signs / no unauthorized entry signs place up to warn members of public of construction area. - No / insufficient dust control. - No/insufficient cleaning of existing public road areas.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 025	Interface with adjacent construction activities of other contractors.	- No communication with other contractors on premises in close vicinity of work area.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. Detailed Risk Assessment by Contractor should be done in such a manner that the Health & Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 026	Neighbour interface	- Insufficient protection of neighboring premises by not using safety screens/ hoarding and barricading. - No communication with neighbors regarding noise levels, dust levels and working hours. - No wayleave in place for road closures / lane restrictions. - No / insufficient dust control. - Surrounding roads not cleaned at regular intervals.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 027	Interface with existing tenants.	- Insufficient protection of neighbouring premises by not using safety screens/ hoarding and barricading. - No communication with neighbours regarding noise levels, dust levels and working hours. - No / insufficient dust control. - Surrounding roads not cleaned at regular intervals. - Services to premises not being protected. - Emergency escape routes not being maintained and not left unobstructed. - Poor communication with tenant regarding work effecting the premises.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 028	Night work / After-hours work	- No supervision / inadequate supervision on site during after-hours work. - Inadequate illumination. - Rise in increasing shift length. - Insufficient breaks. - Exposed to extreme temperatures (cold) - Use of drugs on site.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

			Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.							
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 029	Concrete breaking	- Incorrect position and concrete chute not correctly positioned. - Slipping and falling of breakers due to incorrect handling. - Danger offload (concrete) falling or rubble bucket hitting people. - Overloading of surface with building rubble accumulating.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 030	Jack hammer / breaker operations • Use of electrical jack hammer • Use of compressor jack hammer	- Employees not wearing the correct personal protective equipment while using jack hammer. - Hand and arm vibrations can cause white finger syndrome. - Injury to back and joints from manual handling. - Damage to hearing from constant noise. - Electrocution from faulty equipment or from operating in wet areas. - Operator losing control over the tool. - Foreign objects entering employees' eyes. - Damage to existing services.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 031	Use of lifting tackle	- Use of unsafe lifting tackle. - No test certificate available for lifting tackle.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce	As far as possible have a picture which can be of benefit for illiterate	N/A	H&S	6	E	6E	Occupational Health and Safety Act and

		- Lifting tackle not inspected by competent LMI at required intervals. - Lifting tackle not conspicuously and clearly marked. - Defective lifting tackle being used on site. - Lifting tackle exposed to extreme weather conditions. - Lifting tackle not stored correctly.	the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	readers when the detailed risk assessment is done.						Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 032	Crane handling on • Mobile crane. • Crane truck.	- Loading of crane including outriggers can do damage to underground services. - Unsafe lifting methods. - No competent banks man / rigger appointed and present during lifting processes. - Operator of crane not appointed & not competent. - Operator not conducting pre-start check on crane before operating. - Load being lifted is too heavy. - Employees walking underneath suspended load. - Operators' visibility restricted during the lifting process. - Incorrect lifting tackle used to lift materials. - Load swinging / load out of control – employees being struck by load. - Toppling over / falling over of crane due to overloading. - Mobile crane / crane truck positioned on uneven surface / close to excavation edge. - No spreader plates / sole plates placed underneath the outriggers of the mobile crane / crane truck if required.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 033	Operating of construction vehicles and mobile plant • Transport of employees &	- A construction vehicle can bump into another. - A construction vehicle can bump/drive over pedestrians. - Unauthorized use of construction vehicle and mobile plant.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and

	materials to site. • Operating plant on site.	- Operator of construction vehicle not appointed and not competent. - No reverse hooter installed / not in working condition. - Operator not conducting pre-start inspection on machine before operating. - Operator leaving the vehicle / plant unattended whilst the engine is still running or with the key still in the ignition. - Operator speeding on site. - Construction vehicle / mobile plant parked at an incline without stop blocks being put in place behind the wheels.	The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	done.						incorporated safety standards.

No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
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BLD 034	Operating of construction vehicles and mobile plant • Transport of employees & materials to site. • Operating plant on site. • Operating plant in public area	- Construction vehicle or mobile plant overturning. - Construction vehicles and mobile plant operating in close vicinity or next to power lines. - Inclement weather. - Operator speeding on site. - Unauthorized / unsafe transportation of employees. - Integration between pedestrians and construction vehicles not planned and controlled.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 035	Use of compressors	- Dirty hoses being used, cannot see damages to hose. - Hose fittings not secured properly. - Hoses lying across the floor or walkway, being a tripping hazard for employees in the vicinity. - Hose ends not secured can cause whipping and serious injuries to employees. - Employees working with the compressor or in close vicinity not wearing the required personal protective equipment.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

		- Pressure test of pressure tank not conducted every 36 months. - No fire extinguisher available in close vicinity. - Operator not conducting a pre-use inspection on compressor before use. - Air hoses not secured with safety chains to prevent whipping. - Pressure regulators not in working condition.	Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.							
BLD 036	Edge barricading • Erecting & dismantling of edge barricading.	- No solid edge barricading installed on all open edges of buildings / excavations where there is a fall risk to employees. - Edge barricading not secured into position. Only installing guard rails and no knee rails in scaffolding tubing or similar system. - Edge barricading not inspected daily. - Unauthorized removal of edge barricading.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 037	Ladders	- Damaged ladder being used on site. - Ladder not inspected before use. - Ladder not positioned on level ground surface. - Employee using ladder unsafely. - Incorrect ladder being used for activity being performed. - Materials (tools & equipment) falling from ladder. - Ladder not clearly marked / identified by means of a number and not inspected by the appointed Ladder inspector. - Ladder not recorded on the ladder register. - Ladder not fitted with non-skid devices at the bottom ends and hooks or similar devices at the upper ends of the stiles. - Ladders not stored correctly.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 038	Hand tools	- Tools not inspected prior to use or issue. - Strike injuries to hand. - "Home – made" hand tools being used.	The Principal Contractor or their appointed Contractor should have a detailed	As far as possible have a picture which can be of benefit for	N/A	H&S	6	E	6E	Occupational Health and Safety Act and

		- Cuts from sharp blades.	Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	illiterate readers when the detailed risk assessment is done.						Regulations (85 of 1993) and incorporated safety standards.
BLD 039	Stacking and storage	- Brick pallets double stacked and not secured by being tied or wrapped. - Brick pallets double stacked next to public areas. - No Stacking & storage supervisor appointed. - Laydown areas not inspected weekly by appointed person. - Use of an unsuitable pallets for the loading or storage methods of bricks and other materials. - Continued use of damaged pallets. - Insufficient storage areas provided. - Storage areas not demarcated and clearly identified. - Storage areas not kept neat and under control. - Employees removing materials from the bottom of the stack and not from the top.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 040	Housekeeping	- Materials / equipment not stored properly. - Waste, scrap and debris not removed from site at appropriate intervals. - Materials on site obstructing means of access to and from site / work areas and passageways / walkways. - Materials not being used on site is accumulating and not removed. - Construction sites not properly / sufficiently fenced off and access points not being controlled. - Catch platforms not erected where overhead work is taking place.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

		- No Housekeeping supervisor appointed as per the Safety Agent Specification. - No weekly housekeeping checklist completed as per the Safety Agent specification.	structures are assured at all times.							
BLD 041	Storage and use of flammable liquids	- Flammable liquids solids, and gasses not stored correctly. - Required notices and signs not clearly displayed in the area where flammable liquids, solids or gasses is stored / located. - No fire extinguishers / insufficient fire extinguishers available in close proximity. - Material safety data sheets not available & not communicated with employees.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 042	Fire Fighting • Fire fighting • Fire prevention • Fire extinguisher • Extinguishing of fire.	- No competent fire equipment inspector appointed. - Not sufficient employees trained in firefighting. - No suitable and sufficient fire-extinguisher equipment available. - Fire extinguishers not clearly identified in terms of a number and not inspected monthly by a competent person. - Fire extinguisher not serviced at required intervals. - Incorrect type of fire extinguisher available.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	
BLD 043	Paving & Kerbs	- Employees inhaling dust from cutting of paving. - Employees not wearing the required personal protective equipment. - Unsafe handling of materials. - Unsafe stacking of materials on site. - Employees using unsafe hand tools.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and

		- Employees being exposed to vibration from using compacting tools. - Employees can sustain hand injuries if their hands become trapped in between paving blocks as they are being positioned. - Employees being exposed to noise from using the compacting tools. - Employees being exposed to extreme temperatures. - Area not properly barricaded if in a public area – possible tripping hazard for members of public. - Paving blocks not laid level – possible tripping hazard. - Unsafe electrical tools being used on site.	The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	done.						incorporated safety standards.
BLD 044	Emergency preparedness and response • Emergency plan and procedures. • Emergency contact numbers. • Emergency drill.	- Principal Contractors' emergency plan and procedures not issued to subcontractors on site and not communicated with all employees. - Emergency plan not being revised as deemed necessary by changes in construction site. - Emergency contact numbers not made available and displayed in prominent areas on site. - Emergency evacuation drill not conducted at least once every 6 months. - Principal Contractor not appointing competent Emergency evacuation controller as per The Safety Agent specification. - When working at existing shopping centres / offices that fire escape and emergency routes are being obstructed.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
No.	Potential Hazard	Potential Risk (Source of the potential risk)	Controls (Occupational Health and Safety)	Pictorial (where available)	Existing Controls (Environmental)	H-S-E Identification	Risk Rating			Legal Reference
							S	**L**	**Final Rating**	

BLD 045	Incident Reporting procedures • First Aid • First aid dressing register • Incident investigations • Reporting of incidents to Department of Labour	- Incidents not reported as per the Safety Agent specification. - Incidents not being reported to the supervisor immediately or before end of shift. - Incident report not comprehensive in terms of the requirements as per the Safety Agent specification. - Incident not investigated by competent appointed person. - Preventative measures not communicated to employees on site. - Employees not being trained on Incident reporting procedures. - No trained First aider appointed. - No first aid kit readily available on site.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. Detailed Risk Assessment by Contractor should be done in such a manner that the Health & Safety of persons, safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.
BLD 046	Incident Reporting procedures • First Aid • First aid dressing register • Incident investigations • Reporting of incidents to Department of Labour	- No first aid kit sign displayed. - Name and contact details of trained appointed First Aider not displayed on Emergency contact numbers or on first kit if applicable. - Monthly inspections not being done on first aid kit to ensure legal compliance. - All usage of first aid kit not recorded on dressing register.	The Principal Contractor or their appointed Contractor should have a detailed Risk Assessment to reduce the high risk rating to within a lower controlled risk rating. The detailed Risk Assessment by the Contractor should be done in such a manner that the Health and Safety of persons, the safe guarding of machinery and structures are assured at all times.	As far as possible have a picture which can be of benefit for illiterate readers when the detailed risk assessment is done.	N/A	H&S	6	E	6E	Occupational Health and Safety Act and Regulations (85 of 1993) and incorporated safety standards.

Designation	Name	Signature	Date
Appointed Client Health & Safety Agent / Risk Assessor	CPJ Lourens ©		2018/04/17

TYPE OF WORK PERFORMED: _____

DATE COMPLETED: _____

ASSESSMENT PERFORMED BY: _____

Step No.	Activity Rules	What can cause injury/damage?	Result of cause (injury/damage)	Preventative Measures (tools, PPE, equipment)	Controls (test, check list)	Weights		
1.	Access to be a main consideration when positioning offices, stores and parking areas on site during planning stage. Possible one way traffic to be introduced	Restricted access to parking and delivery areas to storage areas.	Damage to transport and plant	Proper layout of site by Construction Manager and Site Agent taking into consideration all transport plant and material movements and storage on site.	Site Agent to check layout Drg. To compare with OHS Act requirements and whether they are to Concor's standards.			
2.	Oxygen and acetylene store to be a minimum distance of five metres away from other buildings. It needs to be well ventilated and have a roof to keep direct exposure to the sun.	Fire explosion leaking gas may spread if to close to other buildings.	Damage to property and plant. Health of employees.	See item 1.	See item 1.			
3.	Diesel tanks to be a distance of 10 metres away from any building and parking areas. A slab with a bund wall capable of carrying 110% of the tank capacities must be constructed for the tanks to stand in.	Fire may spread to adjacent buildings and plant if is too close.	Burns on all parts of body. Damage to plant and property.	See item 1. Persons in charge of tanks should be inducted regarding all the hazards involved and how to control them	See item 1. Supervisor to monitor on an ongoing basis if rules are complied with			

Step No.	Activity Rules	What can cause injury/damage?	Result of cause (injury/damage)	Preventative Measures (tools, PPE, equipment)	Controls (test, check list) During erection & ongoing	Weights		
						Safety	Health	R/R
4.	All cables from distribution board to offices, store and for security to be under-ground. The distribution board is to stand on a firm level base and should be locked at all times.	Damaged cables loose wires exposed.						
5.	Security fencing minimum height of 1.8 meter around site area together with two double gates.	Theft of property. Access to unauthorised persons.	Loss of property. Injury to persons.	Security guards to be appointed to keep watch.	Supervisor to put system of control in place			
6. **6.1** **6.2** **6.3** **6.4** **6.5**	Services to be available during site establishment. Fire fighting equipment. First aid boxes. First aider. Drinking water. Toilets.	Not having the essential services at hand.	Health of employees. Loss of property through fire.	6.1 to 6.5 are to be included on first order placed for contract. Dry chemical powder ABCDE fire extinguishers to be ordered 4 off for start.	Site Agent to see that these requirements are on site from start of site establishment.			
7.	Water tank tower to consist of very well cross braced pipe structure standing on concrete base.	Badly constructed water tower under designed structurally could cause tower to collapse.	Injury to persons. Damage to property.	Supervisor to erect as per design office specifications.				

Step No.	Activity Rules	What can cause injury/damage?	Result of cause (injury/damage)	Preventative Measures (tools, PPE, equipment)	Controls (test, check list) During erection & ongoing	Weights		
8.	Safety sign & notice board to be placed close to entrance of main gate	Not informing employees and public what the site rules are.	Injury to persons. Damage to property.	Concor standard notices/ Posters to be displayed. Available from Head Office.	Site manager to check that board has been erected.			
9.	Laydown areas to be sufficient in size. timber poles to be available to stack materials on.	With inadequate space various materials will be stacked on top of each other causing unstable stacks.	Injury to persons loading, unloading materials.	Allow sufficient space for lay down area during planning stage of site layout. Access to be considered important.	Site agent to discuss with Foreman regarding his requirement at planning stage.			
10.	Toilets are to be well ventilated.	No ventilation in toilets may cause germs to propagate.	Possible health problems due to germs.	Extraction fans to be fitted if required.	Supervisor to check if he is satisfied with ventilation.			

ASSESSMENT: 1 – 10 (HIGH) 11 – 16 (MEDIUM) 17 – 25 (LOW)

RISK ASSESMENT: EXCAVATIONS (PLANT AND MANUAL)

TYPE OF WORK PERFORMED: _____ **DATE COMPLETED:** _____

ASSESSMENT PERFORMED BY: _____

Step No	Activity Rules	What can cause injury/damage	Result of cause (injury/damage)	Preventative measures (tools, PPE, equipment)	Controls (test, checks)			
	When using a machine to excavate, observe the following:					**Safety**	**Health**	**Finan.**
1	Operator must ensure there are no employees working in this area.	Employees not visible to operate or moving machine.	An injury to all parts of the body and as well as more serious fatal injuries.	Operator must work under close supervision. He must inspect the work area prior to commencing work.	Supervisor to ensure employees are informed and operator works under his supervision.			
2	Machine not to operate while employees are working in same excavations.	Danger of injury of employee by machine.	Bruises, scratches, fractures and fatal.	Supervisor must instruct operator when to commence work.	Supervisor to control and enforce procedure.			
3	All excavated materials must be discharged not closer that 2m from the edge of the excavation. When excavating manually, observe the following. See original	Materials can fall onto employees and the excavation may need extra work.	Injuries to employees and the excavation may need extra work.	Supervisor must instruct operator where to place discharged soil and gravel.	Supervisor to control.			
4	Using a pick and a shovel.	Unsafe use of a pick or a shovel.	Injury to employees.	Induct employees on safe working procedures.	Supervisor and charge hand to control.			
5	Check sides of excavations.	Unstable / loose material causes unsafe condition.	Injury to employees and damage to excavations.	Supervisor to inspect sides on a regular basis.	Supervisor / charge hand to control.			

6	Excavated material to be placed away from side of excavation.	Materials can fall onto employees when working inside the excavation.	Bruises, scratches, fractures and fatal.	Employees to be instructed not to place loose soil on edge of the excavation.	Supervisor to control.			
7	All excavations deeper than 1,5 m must have an access ladder available for employees to get into and out of the excavation safely.	Employees not able to enter or exit the excavation safely.	In case of an emergency too many employees may be buried as a result of inadequate access. Employees may also strain muscles to get into or out of an excavation without safe and convenient access.	Providing a ladder makes access into and out of the excavation area easy and safe.	Supervisors to ensure employees are given safe and convenient access to excavations.			
8	Sides of excavation to be shored (if necessary) and barricaded immediately.	Sides may collapse. Employees may NOT BE AWARE OF THE EXCAVATION AND FALL INTO IT.	Damage to the excavation. Injury to employees,	Put adequate shoring and strong physical barricades in place immediately.	Supervisor and chargehand to control.			
9	Excavations must be backfilled as soon as possible after excavation.	Excavations could collapse. Employees could trip and fall in. Vehicles and machinery could damage excavations.	Damage to excavations. Injury to employees. Damage to plant and machinery.	Keep area barricaded with a strong physical barricade and backfill as soon as possible.	Supervisor and chargehand to control.			

ANNEXURE 4

PRO FORMA HEALTH AND SAFETY AUDIT REPORT FOR USE BY THE AGENT OF THE CLIENT

Key

*	Complies with legislation
**	Does not comply with legislation. See comments.
N/A	Not applicable to the construction site at the time of this audit

SECTION A: WRITTEN APPOINTMENTS	
1. Section 16(2) appointment for S&B Construction	*
2. Construction supervisor	*
3. Principal contractor by client	*
4. Safety agent by client	*
5. Health and safety representatives (1 for every 20 workers)	*
6. Health and safety committee	*
6. Scaffolding supervisor	*
7. Suspended platform supervisor	
8. Risk assessor	*
9. Subcontractors	*
10. First aid officer with competency certificate	*
11. Formwork and support work supervisor	*
12. Demolition supervisor	*
13. Accident and incident investigator	*
14. Batch plant operator	
15. Batch plant supervisor	
16. Excavation supervisor	*
17. User of explosives	
18. Construction vehicles inspector	*
19. Mobile plant inspector	*
20. Construction safety officer	*
21. Material hoist inspector	
22. Temporary electrical installations and machinery inspector	*
23. Fire-fighting equipment inspector	*
24. Explosive powered tools controller	
25. Stacking and storage supervisor	*
26. Fall protection planner	*
SECTION B: LEGAL DOCUMENTS	
1. Health and safety file with prescribed contents for subcontractor Interlock Paving	**
2. Health and safety file with prescribed contents for subcontractor Starcom	**
3. Notification of construction work to Department of Labour	*
4. Notification of passenger lift to Department of Labour	
5. Insurance letter of good standing (COID).	
6. SAPS certificate for use of explosives	
7. Health and safety specifications from client	*
8. Method statement for use of explosives	
9. Copy of the OHS Act	*
10. Copy of the Construction Regulations 2014	*
11. Emergency plan	*
12. Evacuation procedure	*
13. Public liability insurance	*
14. Health and safety plan	*

15. Health and safety file	*
16. Risk assessment for specific site with periodic updates	*
17. Fall protection plan	*
18. Health and safety induction training proof	*
19. Safety toolbox talks record	*
20. Engineering drawings and design changes	*
21. Material safety data sheets (MSDS) for hazardous substances	*
22. Site visitors' register	*
23. Engineer's / designer's report	*
24. Accident / incident investigation report	*
25. Minutes of health and safety committee meetings	*
26. Client or agent safety audit reports	*
27. First aid dressing record	*
28. Soil stability certificate for tower crane	
29. Ready for commissioning certificate for tower crane	
30. Explosive powered tool control document	
31. Receipt by workers of personal protective clothing and equipment	*
32. Record of incidents and near misses	*
33. Mobile crane calibration and load test certificates	*
34. Crane maintenance certificate	*
35. Hepatitis-B injection certificates	*
SECTION C: INSPECTION REGISTERS	
1. Explosive powered tools	
2. Internal inspections by safety officer	
3. Formwork and support work	*
4. Scaffolding	*
5. Excavations	*
6. Demolition work	
7. Construction vehicles	*
8. Mobile plant	*
9. Stacking and storage	*
10. Material hoist	
11. Material conveyor	
12. Hand tools	*
13. Batch plant	
14. Crusher plant	
15. Ladders	*
16. Portable electrical equipment	*
17. Electrical installations, distribution boards and machinery	*
18. Fire-fighting equipment	*
19. Fall arrest equipment	*
20. Tower crane	
21. Mobile crane	*
22. Lifting equipment	
23. Hazardous materials	*
24. Welding equipment	*
25. Troxler density meter radioactivity test certificate	*
SECTION D: SITE-SPECIFIC PHYSICAL COMPLIANCE	
1. Condition of ladders	*
2. Site fencing, hoarding and barricading	*
3. Traffic warning signs	*
4. Construction warning signs	*
5. Excavation work	*
6. Scaffolding	*

7. Overhead power lines adjacent to the site	*
8. Underground services	*
9. Chemical toilets or ablution block	*
10. Machine guarding	*
11. Personal protective clothing and equipment	*
12. Electrical equipment	*
13. Transportation of workers	*
14. Overhead protective netting	
15. Working near water	
16. Use of correct tools and equipment for the task	*
17. First aid kit and contents list	*
18. Safety distance from open excavations and edges	*
19. Fire extinguishers	*
20. Access control to construction site	*
21. Proper illumination	*
22. Housekeeping	*
23. Shelter for workers	*
24. Open decks and edges	*
25. Safe access to excavations and high working places	*
26. Public traffic safety	*
27. Fire prevention measures	*
28. Horseplay on site	*
29. Attitude towards safety on site	*
30. Weather conditions on site	*
31. Physical disabilities	*
32. Hand tools	*
33. Escape routes	*
34. Emergency assembly point	*
35. Control of visitors while on site	*
36. Safety lock-outs	
37. Communication on site	*
38. Support work	*
39. Pollution	*
40. Flammable gas cylinders	*
41. Vessels under pressure	
42. Confined spaces	*
43. Construction vehicles and machinery	*
44. Site-specific health and safety risk assessment: See ***Addendum A***.	*
45. HIV/AIDS, Tuberculosis and Injury statistics	*
46. HIV / AIDS awareness	*
SECTION E: SITE-SPECIFIC OBSERVATIONS AND COMMENTS	
1.	
2.	

ADDENDUM A

CLIENT RISK ASSESSMENT ON THE CONSTRUCTION SITE

Updated:

A. EXPLANATORY NOTES

(a) Hazard:.....The potential ***cause*** of or exposure to a dangerous incident that could lead to
.....
.....personal injury or damage to assets.

Risk: A dangerous ***incident*** that could lead to injury or damage.

(b) Probability .....
.....
.....
.....
.....

High probability (3): Injury could happen today
Medium probability (2): Injury will probably happen in 6 months
Low probability (1): Injury will probably not happen

Severity

High severity (3): Death or permanent disability or loss of a limb (amputation)
Medium severity (2): Hospitalised for less than 14 days
Low severity (1): First aid on site is sufficient

Risk rating

1 Acceptable
2 Low
3 Medium
4 Record in register
6 Needs PPE and medical surveillance
9(*) Potential catastrophe with loss of lives and/or serious damage to assets

Updates

This risk assessment may be updated as the construction work progresses and new site-specific information becomes available.

B. HAZARD IDENTIFICATION AND RISK RATING

Hazard	Risk	Probability of injury [A]	Severity of injury [B]	Risk rating [A*B]
1. Fire arms	• No or wrong PPE • Worker fights • Worker injuries or fatalities • Public injuries or fatalities			*
2. Scaffolding and working at heights	• No or wrong PPE • Workers falling • Worker injuries or fatalities			*
3. Public traffic	• No or wrong PPE • Vehicle collisions • Pedestrian collisions			*
4. Overhead power lines	• No or wrong PPE • Electrocution from overhead cables • Worker injuries or fatalities			*
5. Open decks	• No or wrong PPE • Workers falling through or off • Worker injuries or fatalities			
6. Excavations	• No or wrong PPE • Walls collapse on workers • Suffocation • Worker injuries or fatalities			*
7. Falling objects	• No or wrong PPE • Workers below injured • Machines or assets below damaged			
8. Mobile cranes	• No or wrong PPE • Operator not trained • Worn rope • Break failure • Unstable soil • Wind forces • Crane falling over • Worker injuries or fatalities			*
9. Planks with protruding nails	• No or wrong PPE • Worker foot injuries • Tetanus • Worker injuries or fatalities			
10. Obstacles in walkways	• No or wrong PPE • Workers trip • Worker injuries or fatalities			
11. Compressed air equipment	• No or wrong PPE • Burst lines • Pressure shock wave • Worker injuries or fatalities			
12. Open trenches	• No or wrong PPE • Workers falling in • Public falling in • Injuries or fatalities			

13. Gas welding and cutting	• No or wrong PPE • Fire on site • Gas cloud explosion • Worker injuries or fatalities			*
14. Soil vibrator	• No or wrong PPE • Untrained operator • Mechanical fault • Worker injuries or fatalities			
15. Compactor	• No or wrong PPE • Untrained operator • Mechanical fault • Worker injuries or fatalities			
16. Bomag	• No or wrong PPE • Untrained operator • Mechanical fault • Worker injuries or fatalities			
17. Confined spaces	• No or wrong PPE • Worker medically unfit • Suffocation • Trauma • Worker injuries or fatalities			*
18. PPE	• No or wrong PPE • Workers do not use • Worker injuries or fatalities			*
19. Vehicles moving around on site	• No or wrong PPE • Vehicle collisions • Pedestrian collisions • Vehicles slipping against slopes • Worker injuries or fatalities			*
20. Concrete and cement	• No or wrong PPE • Cementosis • Dermatitis • Worker injuries or fatalities			
21. Alcohol and drugs on site	• No or wrong PPE • Workers fighting • Workers incapable • Worker injuries or fatalities			
22. Commissioning and testing of gas installations	• No or wrong PPE • Gas leaks • Gas cloud explosions • Gas fire • Worker injuries or fatalities			
23. Support work	• No or wrong PPE • Collapsing of structures • Workers falling off • Worker injuries or fatalities			
24. Domestic waste	• No or wrong PPE • Attraction of rodents • Attraction of snakes • Worker injuries or fatalities			
25. Mechanical excavators	• No or wrong PPE • Untrained operator • Mechanical fault • Worker injuries or fatalities			

26. Manholes	• No or wrong PPE • Open holes • Workers or public falling in • Injuries or fatalities			*
27. Installation of LPG systems	• No or wrong PPE • Gas leaks • Gas cloud explosions • Gas fire • Worker injuries or fatalities			*
28. Electrical extension cords	• No or wrong PPE • Bad condition • Bad connections • Electrocution • Gas leaks • Gas cloud explosions • Gas fire • Worker injuries or fatalities			*
29. Ladders	• No or wrong PPE • Broken ladders • Ladder overload • Worker injuries or fatalities			*
30. Explosive powered tools	• No or wrong PPE • Wrong use • No control • Untrained operator • Worker injuries or fatalities			*
31. Construction vehicles working near cliff	• No or wrong PPE • Vehicles falling off cliff • Worker injuries or fatalities			*
32. Open electrical wires and cables	• No or wrong PPE • Damage to cables or wires • Electrocution • Fire • Worker injuries or fatalities			*
33. Temporary steps	• No or wrong PPE • Unstable steps • Poor construction • Workers falling off • Worker injuries or fatalities			*
34. Flammable materials	• No or wrong PPE • Fire on site • Toxic combustion fumes • Worker injuries or fatalities			*
35. Housekeeping	• No or wrong PPE • Obstacles • Rats and snakes • Worker injuries or fatalities			
36. Bites from reptiles and insects	• No or wrong PPE • No medical assistance • Worker injuries or fatalities			
37. Paints and solvents	• No or wrong PPE • Fire on site • Toxic fumes • Worker injuries or fatalities			*

38. Electrical distribution boards	• No or wrong PPE • Damage to cables or wires • Electrocution • Fire • Worker injuries or fatalities			*
39. Chemical toilets	• No or wrong PPE • Not sufficient sanitation fluid • Bee nests (wasps) • Fly infestation • Cholera • Typhoid • Worker fatalities			
40. Portable electrical tools	• No or wrong PPE • Poor condition • Damaged tools • Worker injuries or fatalities			
41. Traffic accidents	• No or wrong PPE • Vehicle collisions • Pedestrian collisions • Worker injuries or fatalities			*
42. Construction dust	• No or wrong PPE • Silicosis • Eye infection • Worker injuries or fatalities			
43. Lifting equipment	• No or wrong PPE • Poor slings / tackle • Broken slings / tackle • Worn rope • Unstable equipment • Break failure • Operator not trained • Worker injuries or fatalities			*
44. Stacking and storage	• No or wrong PPE • Stacking too high • Instability of stack • Unstable soil • Objects falling over • Worker injuries or fatalities			
45. Safeguarding of moving parts on machinery	• No or wrong PPE • Flying fragments • Limb caught in machine • Clothing caught in machine • Worker injuries or fatalities			
46. Workers safety training	• No or wrong PPE • Untrained workers • No safety awareness • Worker injuries or fatalities			*
47. Air conditioning ducting	• No or wrong PPE • Poor ventilation • Suffocation • Fire caused by glue or solvents • Worker injuries or fatalities			*
48. Machines near excavations	• No or wrong PPE • Unstable soil • Machines falling into excavations • Worker injuries or fatalities			

49. Construction vehicles operating against slopes	• No or wrong PPE • Slippery surface • Vehicles slipping • Worker injuries or fatalities			
50. Shuttering	• No or wrong PPE • Structure collapse • Suffocation • Worker injuries or fatalities			
51. Unstable soil conditions	• No or wrong PPE • Workers slipping • Machinery slipping • Structures falling over • Worker injuries or fatalities			*
52. Working near water	• No or wrong PPE • Slippery conditions • Wall collapsing • Workers drowning • Worker injuries or fatalities			
53. Demolition	• No or wrong PPE • Use of explosives • Dust • Falling objects • Structures falling over • Worker injuries or fatalities			
54. Use of explosives	• No or wrong PPE • No SAPS certificate • Operator not registered • Operator not competent • No method statement • Wrong use of explosives • Worker injuries or fatalities			*
55. Inspection registers not completed	• No or wrong PPE • No inspections • Unsafe practices • Unsafe equipment and machinery • Worker injuries or fatalities			
56. Loading and offloading	• No or wrong PPE • Falling objects • Loose loads • Worker injuries or fatalities			
57. Fires on site	• No or wrong PPE • Secondary fires • Thermal radiation • Suffocation • Worker injuries or fatalities			*
58. Blasting on site	• No or wrong PPE • No SAPS certificate • Operator not registered • Operator not competent • No method statement • Wrong use of explosives • Worker injuries or fatalities			

59. Transporting of heavy objects	• No or wrong PPE • Falling objects • Loose loads • Worker injuries or fatalities			
60. Drilling	• No or wrong PPE • Flying debris • Dust • Eye injury • Silicosis • Worker injuries or fatalities			
61. Piling	• No or wrong PPE • Flying debris • Uncovered machine parts • Dust • Eye injury • Silicosis • Worker injuries or fatalities			
62. Transport of workers	• No or wrong PPE • Unsafe place to sit • No canopy • Workers falling off • Worker injuries or fatalities			
63. Ramps	• No or wrong PPE • Vehicles slipping • Pedestrians slipping • Collapsing of ramps • Worker injuries or fatalities			
64. Workers not trained for jobs	• No or wrong PPE • Unsafe practices • Unsafe equipment and machinery • Worker injuries or fatalities			*
65. Workers not trained in health and safety	• No or wrong PPE • Unsafe practices • Unsafe equipment and machinery • Worker injuries or fatalities			*
66. Weather conditions	• No or wrong PPE • Slippery surfaces • Poor visibility • Wind resistance on high structures • Lightning strikes • Electrical shorts • Worker injuries or fatalities			
67. Use of trolleys	• No or wrong PPE • No or wrong PPE • Slipping loads • Overload • Run-away trolley • Worker injuries or fatalities			
68. Lack of safety supervision	• No or wrong PPE • Unsafe practices • Unsafe equipment and machinery • Worker injuries or fatalities			*

69. Flying debris	• No or wrong PPE • Head injury • Eye injury • Damage to flammable material containers • Worker injuries or fatalities			
70. Illumination of work places	• No or wrong PPE • Poor visibility • Workers tripping • Workers falling through openings • Worker injuries or fatalities			
71. Temporary worker accommodation	• No or wrong PPE • Unhygienic conditions • Poor drinking water quality • Rodents • Snakes • Children on site • Worker injuries or fatalities			
72. Stop and go traffic control points	• No or wrong PPE • Operators no training • Poor communication between successive control points • Power failures • Traffic lights not working • Public vehicles speeding • Loose gravel on the road • Flying stones • Worker injuries or fatalities			
73. Security on site	• No or wrong PPE • Theft • Armed robbery • Unauthorised access to site • Worker injuries or fatalities			
74. Concrete pump	• No or wrong PPE • Pipe pressure burst • Concrete spurting out under pressure • Eye injury • Dermatitis • Worker injuries or fatalities			
75. Lockable containers used for storage	• No or wrong PPE • Fire in container • Confined space • Suffocation • Worker injuries or fatalities			
76. Ventilation at work place	• No or wrong PPE • Suffocation • Fire from solvents, paint, glue • Worker injuries or fatalities			*
77. Public awareness of construction site hazards	• No or wrong PPE • No warning signs • Uncontrolled access by public • Public injuries or fatalities			

78. Asbestos	• No or wrong PPE • Contact with asbestos • Asbestosis • Worker injuries or fatalities			
79. Lead	• No or wrong PPE • Contact with lead • Worker injuries or fatalities			
80. Workers exceeding allowable working hours	• No or wrong PPE • Worker fatigue • Unsafe practices • Worker disability • Worker injuries or fatalities			*
81. Roof work	• No or wrong PPE • Falling from heights • No inspections • Slipping on roof • Wet conditions • Roof not well supported and collapsing under workers • Worker injuries or fatalities			*
82. Hand tools	• Bad condition • No or wrong PPE • No inspections • Worker injuries or fatalities			
83. Construction noise	• No or wrong PPE • No ear protection • Worker injuries or fatalities • Public nuisance			
84. Toxic fumes	• No or wrong PPE • Suffocation • Confined space • Worker injuries or fatalities			*
85. Hygiene	• No or wrong PPE • Infections • Illness such as typhoid and cholera • Insects • Rodents • Snakes • Worker injuries or fatalities			
86. Construction site demarcation	• No or wrong PPE • Public liability • People falling into open trenches and holes • Theft • Worker injuries or fatalities			
87. Emergency evacuation measures	• No or wrong PPE • Chaos on site during emergency • Worker injuries or fatalities			
88. Disposal of waste from heights	• No or wrong PPE • Falling objects • Head injuries • Damage to assets in operation • Dust • Silicosis • Worker injuries or fatalities			*

89. Handling of hot materials	• No or wrong PPE • Toxic vapours • Suffocation • Fires • Burn wounds • Worker injuries or fatalities			*
90. Uneven surfaces	• No or wrong PPE • Workers slipping or tripping • Vehicles falling over • Worker injuries or fatalities			
91. Detours at road works	• No or wrong PPE • Speeding public vehicles • Flying stones • Dust • Poor visibility • Vehicle collisions • Pedestrian collisions • Worker injuries or fatalities			
92. Working at night	• No or wrong PPE • Poor visibility • Vehicle collisions • Pedestrian collisions • Unsafe working conditions • Worker injuries or fatalities			
93. Discarding of empty chemical containers	• No or wrong PPE • Toxic fumes • Suffocation • Fires • Explosions • Worker injuries or fatalities			*
94. Radioactive materials	• No or wrong PPE • Radiation exposure • Worker injuries or fatalities			
95. Working with sharp objects	• No or wrong PPE • Lacerations • Punctures • Worker injuries or fatalities			
96. Visibility of workers	• No or wrong PPE • No reflective jackets • Pedestrian collisions • Construction vehicles knocking workers over • Worker injuries or fatalities			
97. Spillages of hazardous liquids	• No or wrong PPE • Fires • Explosions • Environmental damage • Toxic exposure • Worker injuries or fatalities			*
98. Gas leaks	• No or wrong PPE • Gas cloud explosions • Fires • Toxic fumes • Suffocation • Worker injuries or fatalities			*

99. Underground electrical cables	• No or wrong PPE • Electrocution from damage to cables during excavation • Power failures • Worker injuries or fatalities			*
100. Carrying of heavy objects	• No or wrong PPE • Back injury • Spinal injury • Worker tripping • Limb injury • Worker injuries or fatalities			
101. Use of laser equipment	• No or wrong PPE • Operator no training • Eye & Skin injury • Worker injuries or fatalities			
102. Ergonomic risks	• No or wrong PPE • Muscle tension • Limb injury • Worker falling • Worker injuries or fatalities			
103. Communication on site	• No or wrong PPE • Unclear instructions • Workers not clearly informed • Worker injuries or fatalities			
104. Storage of fuel	• No or wrong PPE • Fire & Explosion • Toxic combustion products • Toxic fumes • Worker injuries or fatalities			*
105. Trench compaction	• No or wrong PPE • Limb injury • Uneven surface • Soil erosion • Worker injuries or fatalities			
106. Backfilling	• No or wrong PPE • Limb injury • Uneven surface • Soil erosion • Worker injuries or fatalities			
107. Shoring and bracing	• No or wrong PPE • Collapsing structures • Suffocation of workers • Excavation wall collapse • Worker injuries or fatalities			
108. Pedestrian walkways	• No or wrong PPE • Workers falling • Obstructions • No handrails • Slippery surfaces • Worker injuries or fatalities			
109. Pouring of ready mix (bulk) concrete	• No or wrong PPE • Dermatitis • Eye injury • Suffocation • Confined spaces • Worker injuries or fatalities			

110. Site establishment	• No or wrong PPE • Bad housekeeping • Unhygienic conditions • No sanitation facilities • Worker injuries or fatalities			
111. Site demobilization	• No or wrong PPE • Bad housekeeping • Unhygienic conditions • No sanitation facilities • Worker injuries or fatalities			
112. Gabion walls	• No or wrong PPE • Wall collapse • Falling objects • Worker injuries or fatalities			
113. Grass and other vegetation next to site	• No or wrong PPE • Veldt fire • Rodents • Snakes • Worker injuries or fatalities			
114. Handling of reinforcing	• No or wrong PPE • Back injuries • Lacerations • Falling objects • Head injuries • Worker injuries or fatalities			
115. Operation of machinery	• No or wrong PPE • Exposed moving parts • Operator untrained • No inspection • Unsafe conditions • Worker injuries or fatalities			*
116. Arc welding	• No or wrong PPE • Fire • Explosion • Suffocation • Toxic fumes • Burn wounds • Worker injuries or fatalities			
117. Soldering	• No or wrong PPE • Suffocation • Toxic fumes from lead • Burn wounds • Worker injuries or fatalities			
118. Laying of bricks	• No or wrong PPE • Falling bricks • Lacerations • Skin damage • Worker injuries or fatalities			
119. Servicing of vehicle on site	• No or wrong PPE • Oil spills • Fuel spills • No chocks behind wheels • Lifting equipment in raised position • Worker injuries or fatalities			*

120. Servicing of mobile plant on site	• No or wrong PPE • Oil spills • Fuel spills • No chocks behind wheels • Lifting equipment in raised position • Worker injuries or fatalities			*
121. Servicing of electrical equipment on site	• No or wrong PPE • Electrocution • Not switched off • Fire • Explosion • Worker injuries or fatalities			*
122. Compressed air equipment	• No or wrong PPE • Burst pipes and vessels • Poor hose connections • Worker injuries or fatalities			
123. Uneven work terrain	• No or wrong PPE • Workers slipping • Vehicles slipping and falling over • Vehicle collisions • Pedestrian collisions by vehicles • Worker injuries or fatalities			
124. Use of LPG	• Fire • Gas cloud explosion • Toxic effect of unignited gas			*
125. HIV/AIDS	• Worker infection from local surrounding community • Absenteeism • Death • Project delay			*
126. Tuberculosis	• Worker infection from local surrounding community • Absenteeism • Death • Project delay			*
127. Hepatitis-B	• Infection from raw sewage • Absenteeism • Death • Project delay			*
128. Dolomite substrata	• Sinkholes • Excavations caving in • Death			*
129. Security at Air Force Base	• VIP passenger protection • Unexpected flights and runway clearance • Death			*
130. Aircraft movement	• Workers too close to the runway • Noise • Engine thrust • Injury or death			*

PL: PARTICULAR SPECIFICATION: PIPE JACKING AND BORING

PL 1 SCOPE

This section coverts the insertion, by jacking and boring, of underground pipes without disturbing the surface.

PL 2 APPLICATION

The information regarding pipe jacking and boring contained in this section is not limited to the jacking of circular precast concrete pipe sections but also applies in general to the jacking of rectangular, square and arched precast-concrete sections. Where boring is to be carried out, the Contractor shall, as is the case for jacking, make use of an approved specialist firm.

PL 3 DEFINITIONS

For the purposes of this section, the following words and expressions shall have the meanings hereby assigned to them except where inconsistent with the context.

a) Intermediate jacking stations
A transverse joint in a jacked structure at which jacking is performed.

b) Jacking
The action of pushing a pipeline into position.

c) Jacking frame
A frame on which the jacks are mounted and through which the jacking forces are transmitted.

d) Jacking structure
An assembly comprising the jacking frame, the permanent pipes to be jacked, and the shield.

e) Lead pipe
A pipe that has a rebated end over which the trailing end of the shield is fitted and which is intended to be the first pipe to be used in the jacking process.

f) Pilot hole
A hole with a maximum diameter of 50mm, drilled to ensure that a subsequently bored, larger hole, will be properly aligned.

g) Pipe boring (drilling)
The work involved in boring a horizontal hole and inserting a pipe therein.

h) Pipe boring pits
Excavations at either end of the boring operation from and between which boring and pipe installation are carried out.

i) Reception pit
An excavated shaft located at the end of a jacked section of a pipeline, from which the shield is recovered.

j) Shield
A device located at the leading end of the jacking structure, which is intended to provide protection for workmen at the leading end and to prevent the collapse of the face of the tunnel excavation.

k) Thrust pit
An excavated shaft at the starting point of a jacking operation, in which the jacking structure and other equipment are installed and from which the jacking operations are carried out.

l) Thrust plate
A steel plate placed against the end of the pipe against which the jack operates, and which is intended to ensure that the jacking forces are spread uniformly over the end face of the pipe.

m) Thrust block
A temporary structure constructed inside the thrust pit for the purpose of transferring the jacking forces to the adjacent soil.

PL 4 MATERIALS

PL 4.1 Pipes

Unless otherwise specified, the pipes for jacking shall be reinforced concrete pipes of the SC type and D-load designation 100D which comply with the relevant requirements of SANS 677. The actual diameters of pipes supplied shall be not less that the nominal diameters given on the Drawings or stated in the diameters given on the Drawings or stated in the Schedule of Quantities. In addition to withstanding the specified two (or three) edge-bearing test load, the pipes shall be capable of withstanding, without being damaged, the maximum longitudinal force to be transmitted by the jacks during jacking.

Pipes for pipe boring shall be any of the pipes specified under Section 6: Water or Section 7: Sewer.

PL 4.1.1 Other precast-concrete sections

Any precast-concrete sections, other than pipes, to be jacked shall comply with the requirements specified in the Project Specifications and as shown on the Drawings.

PL 4.1.2 Intermediate jacking stations

Under certain circumstances it may be necessary to provide the one or more intermediate jacking stations between the thrust and reception pits. Such stations shall consist of a pair of modified jacking pipes. In order to protect and form the joint between these pipes, the Contractor shall provide cylindrical mild steel sleeves with a wall thickness of at least 8mm and of such length that they overlap the pipes for a distance of at least 150mm on each side of the joint.

PL 5 PLANT

PL 5.1 General

The Contractor shall in the case of jacking, provide and use suitable equipment for handling pipes and placing them in position for jacking, for jacking the pipes, for the lubrication of the outer surface of the pipeline, and for excavation within the pipe and in the case of pipe boring, for boring the hole, for jointing and inserting the pipes.

PL 5.1.1 Jacks

The jacks shall be fitted with a suitably calibrated pressure gauge in a good working order which will enable the actual jacking forces to be read at any time during the jacking operation. To transfer the load from the jacks to the pipes, suitable thrust plates and spacers shall be provided.

PL 5.1.2 Shield

A suitable shield for fitting to the front of the lead pipe shall be provided by the Contractor to protect workmen and prevent the collapse of the face or roof of the excavation ahead of the jacked structure. The shield shall be directionally adjustable.

PL 5.1.3 Lighting

The Contractor shall provide adequate lighting for the execution of the Works.

PL 5.1.4 Guides

Where necessary, guides shall be provided within the thrust pit to facilitate initial directional control of the pipes.

PL 5.1.5 Ventilation

Sufficient ventilation shall be provided to remove dust and to ensure safe working conditions.

PL 6 DESIGN

The Contractor shall furnish detailed design calculations, specifications and working drawings to explain his methods of installation and of providing temporary support for the road, rail track, or other service or structure and any modifications to structures required before pipe jacking commences. The above information shall, when required by the Engineer, also be provided in the case of pipe boring.

The design shall be carried out by a professional engineer with adequate experience in this field. Calculations, specifications and drawings shall be signed by the engineer responsible for their preparation.

PL 7 SAFETY

PL 7.1 General

It is a requirement of this contract that the Contractor shall provide a safe and healthy working environment and to direct all his activities in such a manner that his employees and any other persons, who may be directly affected by his activities, are not exposed to hazards to their health and safety. To this end the Contractor shall assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act (OHSA) No 85 and Amendment Act No 181 of 1993, and the OHSA 1993 Construction Regulations 2014 by the Department of Labour.

For the purpose of this contract the Contractor is required to confirm his status as mandatory and employer in his own right for the execution of the contract by entering into an agreement with the Employer in terms of the Occupational Health and Safety Act in the form as included in the tender document.

Permission to proceed with the Works shall not in any way detract from the obligations and liabilities of the Contractor in regard to such safety or to the adequacy of the jacking structures and methods of working.

PL 7.1.1 Protection of existing works

The pipeline shall be jacked or bored through under the relevant road, railway or other service or structure without disrupting the traffic and without disturbing the alignment or levels of the road surface, the tracks, or other relevant service or structure to an extent that may impair the safety of traffic or of the service of structure. Before commencing work in the vicinity of any structure, the Contractor shall make a detailed examination of the structure, record its condition, and submit a copy of such record to the Engineer.

PL 7.2 Requirements for Accommodation of Traffic (Read with SANS 1921 - 2: 2004)

PL 7.2.1 General

The Contractor will be responsible for the safe and easy passage of public traffic past and on sections of roads of which he has occupation or where work has to be done near traffic. The travelling public shall have the right of way on public roads, and the Contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not to constitute a hazard on the road.

Accommodation of traffic, where applicable shall comply with SANS 1921-2: 2004: Construction and Management Requirements for Works Contracts, Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor. The Contractor shall obtain this specification from Standards South Africa if accommodation of traffic will be involved on any part of the construction works.

PL 7.2.2 Basic Requirements

The Contractor shall ensure that all road signs, barricades, delineators, flagmen and speed controls are effective and that courtesy is extended to the public at all times. Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the Engineer to suspend the work until the road signs, etc, have been repaired to his satisfaction.

The Contractor may not commence constructional activities affecting existing roads before adequate provision has been made to accommodate traffic in accordance with the requirements of this document and the South African Road Traffic Signs Manual.

The Contractor shall construct and maintain all temporary drainage works necessary. The Contractor shall provide and grant access to persons whose properties fall within or adjoin the area in which he is working.

PL 8 SURVEYING

PL 8.1 General

The Contractor shall take measurements before and after each jacking or boring operation and shall record any change in line or level (or both) of any road, rail track or other service or structure being traversed. A copy of the records shall be submitted to the Engineer on the same day.

PL 8.1.1 Working under roadways

Before commencing work under a roadway, the Contractor shall measure levels on the road surface directly above the jacking line and for a distance of at least 5m on each side of the jacking line. These levels shall be measured at 500mm intervals and 300mm from the edges of the surfacing. In order to facilitate control of the measuring of levels, the exact position of each spot height shall be discreetly marked on the road surface before the levels are measured.

After completion of the Works, the Contractor shall re-measure the levels in the same manner as before, and he shall submit to the Engineer the final records of levels taken before and after jacking. The submission of such records shall be a prerequisite for any consideration by the Engineer of the acceptability or otherwise of the Works of the issue of any certificate of completion.

If, within the Defects Liability Period, the road shows any sign of settlement in the vicinity of the jacked pipe, the road authority may re-measure the levels on the Site.

The Contractor shall be held responsible for the rectification, to the satisfaction of the road authority and the Engineer, of any deformation that occurs in the road surface as a result of the jacking operation during the said period of one year. Should level measurements in accordance with this subclause also be required in respect of boring, it will be specified in the Project Specifications.

PL 8.1.2 Checking the alignment of the pipeline

The Contractor shall check the line and the level of the pipeline at least once during the installation of each pipe length and shall take such corrective action as may be necessary. A copy of the results of all checks and a statement of any corrective measures taken shall be available for inspection on the Site, and a copy shall be given to the Engineer on the same day.

PL 9 BLASTING

No blasting will be allowed for pipe boring. For pipe jacking, no blasting shall be carried out without the prior written permission of the Engineer, and without the necessary approval or clearance having been obtained from the relevant authority.

PL 10 CONSTRUCTION

PL 10.1 General

Jacking, excavation, boring and other specialized work shall be undertaken only by persons fully conversant with the work.

Jacking and boring operations shall commence at the lower level of the pipeline. Should Site conditions necessitate or permit jacking or boring to be carried out from the higher level of the pipeline, the Engineer's written approval shall be obtained before the work commences.

The Contractor shall not commence any work until the Engineer has specified, in writing, that the Contractor may proceed.

- The Roads Superintendent must be informed at least seven days before commencement of any work and shortly before completion thereof in order to make the necessary arrangements for inspection.

- The necessary and prescribed road traffic signs for the proposed work must conform to the SA Manual for Road Traffic Signs. The contractor must provide the signs and erect it to the satisfaction of the Roads Superintendent before commencing.

- The work must be done within twelve months from date of the way-leave application letter.

- The official in charge of the construction or maintenance work on site must, at all times, be in possession of a complete copy of the letter of approval, including the general conditions, special conditions and specific conditions where applicable to the service concerned, as well as all plans that are required and are referred to in the correspondence, so that during an inspection the official can submit it to the official of the controlling authority when requested to do so.

PL 10.2 Excavation

Subject to the provisions of clause 09 above, the appropriate requirements of Section 3: Earthworks (Pipe Trenches) and Section 12: Pipe Drilling shall apply.

a) Classification of materials excavated

The materials excavated shall be classified as follows for payment purposes:

i) Hard material:

Materials which cannot be excavated efficiently except with the use of pneumatic tools, blasting or wedging and splitting, and shall include boulders exceeding 0,15m^3 in volume. Also refer to PSDB-8.3.3 Hard rock excavations.

For pipe boring operations, the material penetrated will be classified as hard when the Contractor can prove that the work cannot be efficiently carried out by using normal boring equipment and some other method, such as rock drilling, has to be used.

ii) Soft material:

All material not classified as hard material. Notwithstanding the above classification, all material in previously constructed fills, embankments and pavement layers and through which jacking or boring is carried out, shall be classified as soft material.

The decision of the Engineer as to the classification of the material shall be final and binding, and any objection as to the classification shall be made before the pipes are jacked or, in the case of pipe boring, some method other than boring is used.

b) Thrust and reception pits and pipe boring pits

The Contractor shall be responsible for excavating the pits in the positions indicated on the Drawings at each end of the section of pipeline or sleeve that is to be jacked. These pits shall be of dimensions at least equal to the minimum dimensions needed for the Contractor's equipment and for safe and efficient working. The approximate dimensions of the pits that the Contractor intends to excavate shall be agreed upon with the Engineer before work commences. The excavated material shall be stockpiled for later backfilling.

The sides of the pits shall be adequately supported by timbers or by other approved means. Where a pit adjoins a railway line or a heavily used road, the sides of the pit shall be shored during the entire operation to prevent any movement cause by vibration arising from rail or road traffic from occurring.

Access pits and work areas may not be closer than 3 meters to the “edge of tar” provided that no excavations be left open overnight, otherwise a distance of 10 meters will apply. The contractor may not use an open trench method.

The Contractor shall ensure that the pits are dewatered at all times.

c) Jacking of pipes

Excavation shall be such that overbreak is kept to a minimum. No material shall be removed in advance of the leading edge where the leading edge is in unstable or loose material. If the material at the face starts to slip or run, excavation shall be stopped immediately and the Contractor shall take such action as may be necessary to stabilize the material before excavation is resumed.

Should any unforeseen cavities be exposed during jacking, such voids shall be filled immediately with grout in a manner approved by the Engineer.

To ensure a minimum of overbreak, the first concrete pipe used shall be so rebated that the outside diameters of the shield and the pipeline will not differ substantially. The Contractor shall ensure that the head of the excavation is drained at all times. Under no circumstances will jetting be permitted.

PL 10.3 Jacking procedure

Each pipe shall be advanced by means of hydraulic jacks of adequate capacity which bear against a suitable trust plate so as to distribute the thrust of the jacks uniformly over the end face of the pipe.

The rear end of each jack shall so bear against a suitably designed structure as to transfer the force to the surrounding material and to distribute it evenly over an area large enough to ensure that the bearing capacity of the soil will not be exceeded and that no structure in the vicinity of the trust pit will be disturbed.

The contractor may, with the written permission of the Engineer, inject a suitable lubricant through preformed holes in the structure or in the shield. Resilient packing material shall be inserted between the faces of successive pipe units so as to distribute the thrust evenly over the circumference of the pipes.

At the conclusion of a day’s work, the shield shall be jacked up to the tunnel face. If intermediate jacking stations are used, the trailing units shall be jacked forward until the jacks in the intermediate stations are in the unextended position. Spacers shall be placed between the jacking frame and the pipe with all the jacks being in the unextended position and ready to jack in an emergency.

PL 10.4 Pipe boring

After the pits have been completed, and on the written instructions of the Engineer, a pilot hole shall be drilled using suitable equipment. After the pilot hole has been inspected and approved, it shall be enlarged by boring to the diameter required for the installation of the specified pipe.

PL 10.5 Grouting and sealing

Before each jacking operation, the Contractor shall determine, in an approved manner, the average cross section of the completed excavation ahead of the pipeline and shall submit his calculations to the Engineer on the same day.

These cross-sections, together with the external pipe diameter, shall be used for calculating the approximate volume of grout that will be needed after the entire jacking operation has been completed and will assist in determining whether all voids have been grouted.

When the jacked / bored pipeline is in its final position, a sand-cement grout shall be injected to fill all voids between the installed pipeline and the surrounding material. The grout shall have a strength equal to or better than a grout consisting of one part of cement and four parts of sand and shall have a slump of 120 mm.

Grouting shall commence at the lower end of the pipeline, and the grout shall be injected through holes drilled through walls of each pipe section.

These holes, which will also be used for checking the progress of the grout, shall be positioned in each side of the pipe on the line of its horizontal diameter, and also in the soffit of the pipe.

All holes in the pipeline shall be sealed with an approved epoxy sealant after the grouting has been completed.

The grouting of the pipes installed by means of pipe boring shall be carried out only on the written instructions of the Engineer and in a manner approved by the Engineer. The grout shall be the same as the grout specified above for jacked pipes.

PL 10.6 Backfilling

When jacking has been completed and the jacking frame and shield have been dismantled, the trust and reception pits shall be backfilled to the extent indicated on the Drawings or as laid down in the Project Specifications or determined by the Engineer on the Site.

The pipe boring pits shall be backfilled, only when so instructed by the Engineer, using excavated or imported material compacted to at least the density of the undisturbed surrounding material.

When the installed pipe is part of a pipeline trench and as such shall be backfilled in the manner specified in Section 3: Earthworks (Pipe Trenches), Section 5: Bedding and Section 6: Water as applicable. Payment for such backfilling will be made under the applicable sections.

Surplus excavated materials shall be disposed of as specified in the Project Specifications or as determined by the Engineer on Site.

PL 11 AS-BUILT DRAWINGS

If an alternative design by the Contractor has been accepted or if the structure shown on the Tender Drawings has been modified to suit the jacking method, the Contractor shall, on completion of the work and before the final payment is made, supply the Engineer with transparencies showing details of the completed structure. Each such transparency shall be certified by the Contractor to be an accurate reflection of the work as constructed.

PL 12 TOLERANCES

Subject to any requirements of the Project Specifications imposed on account of the gradient(s) of the pipeline or in view of the purpose for which it is required, the pipes shall be positioned within the tolerance given below.

Should the difference between the actual and the specified position or alignment of the finished pipeline exceed the value of the said tolerance to an extent as to involve additional costs in respect of locating, installing supporting or maintaining any service of which the jacked or bored pipe forms part or that has been designed to be laid through the jacked or bored structure, the Contractor shall bear such additional costs, provided that the details of the work

to be done to relocate, install, or support the said service have been provided and the order for the work to be done (by the Contractor or by others) has been given by the Engineer within 30 working days of the completion of the jacking or boring operation.

Permissible tolerance limits shall be as following:

a) Pipe jacking

i)	In plan	± 100 mm
ii)	Vertical	± 50 mm
iii)	Horizontal and vertical displacement between units at joints	10 mm maximum

Adjustment to line or level or both shall be gradual, and the manufacturer's permissible angular deflection of the pipes shall not be exceeded at any point.

b) Pipe boring

i)	In plan	± 100 mm
ii)	Vertical	± 50 mm

PL 13 MEASUREMENT AND PAYMENT

Item		Unit
PL13.1	**Establishment on Site for**	
PL13.1.1	Pipe Drilling	lump sum

The tendered lump sums shall include full compensation for the establishment on Site and the subsequent removal of all special equipment and plant for pipe jacking or boring, including the thrust block when applicable, for maintaining the safety of existing structures, services, roads, railways, etc, for bracing, lighting, watching, dewatering and surveying, and for maintaining all temporary works until the work is completed.

This work will be paid for as a lump sum, 80% of which becomes payable when all equipment is on the Site and jacking or boring has commenced, and the remaining 20% will become payable after the work has been completed, the equipment removed and the Site reinstated to a condition acceptable to the Engineer.

Item		Unit
PL13.2	**Access to and from the pipe Drilling pits**	lump sum

The tendered lump sum shall include full compensation for the provision and maintenance of access roads to the thrust and reception pits, the negotiations with owners where applicable, the erection and maintenance of temporary gates, fences and road signs where applicable, and for the removal and reinstatement of the access roads and temporary works on completion of the jacking or boring operations to the satisfaction of the Engineer and landowners concerned. The work will be paid for in two instalments as specified in pay item PL13.1.

Item		Unit
PL13.3	**Excavating in soft material for**	
PL13.3.1	Pipe Drilling Pits	lump sum

The tendered lump sums shall include full compensation for all work necessary for excavating the pits to suit the Contractor's equipment, for excavating by hand where applicable, for shoring the sides of the excavation, and for stockpiling the excavated material at predetermined sites. The work shall be carried out as specified in the appropriate clauses of Section 2: Site Clearance and Section 3: Earthworks (Pipe Trenches), (see subclause 10.2(b) of this section).

Ninety per cent (90%) of the lump sum tendered under subitem PL13.3.1 shall become payable when the excavations have been completed and jacking or boring has commenced and the remaining 10% after the thrust block and shoring have been removed.

Item		Unit
PL13.4	**Extra over item PL13.3 for excavating hard material**	cubic metre (m^3)

The unit of measurement shall be the cubic meter of material measured in the original position before excavation and classified as hard in terms of subclause 10.02 (a). The dimensions of the excavation shall be agreed on as specified in subclause 10.02 (b) of this section.

The tendered rate shall include full compensation for all extra work and effort required for excavating in hard material.

Item		Unit
PL13.5	**Backfilling the**	
PL13.5.1	Pipe Drilling pits with	
PL13.5.1.1	Excavated materialcubic metre (m^3)	
PL13.5.1.2	Imported material	cubic metre (m^3)

The unit of measurement for subitem PL13.5.1 shall be the cubic metre of suitable excavated or imported material used for backfilling the thrust and reception pits to the extend indicated on the Drawings, laid down in the Project Specifications or determined by the Engineer.

The tendered rates shall include full compensation for loading approved material previously excavated or alternatively for loading the material from approved borrow pits, for transporting it to where required and for off-loading, and placing the material.

The tendered rate shall also include full compensation for compacting the material in respect of subitem PL13.5.1.1, in 150 mm thick layers to 90% of modified ASSHTO density.

Material shall be imported only on the instructions of the Engineer and overhaul will be payable where the material is transported outside the free-haul boundaries from sources provided by the Employer.

Item		Unit
PL13.6	**Drilling, installation and securing sleeve in all materials for the following: (description, type and diameter stated)**	metre (m)

The unit of measurement shall be the metre of completed bored / drilled pipeline measured between the ends of the completed pipeline continuously through intermediate boring / drilling stations and shall include intermediate pipes.

The tendered rate shall include full compensation for the supply, delivery and storing the pipes, welding, insertion and testing (in accordance with PSLD: Sewer).

Item		Unit
PL13.7	**The grouting of voids for pipe boring / drilling**	
PL13.7.1	Unforeseen and exposed during drilling / boring	kilogram (kg)
PL13.7.2	Between pipeline and surrounding material after boring has been completed	
	a) Pipe diameter stated	metre (m)

The unit of measurement for subitem PL13.7.1 shall be the mass, in kilograms, of cement used in the grouting operation. The quantity of cement shall be based on a grout mixture consisting of one part cement and four parts of sand by volume. The volume of one pocket of cement (50 kg) shall be taken as being 0.033 m^3.

The unit of measurement for subitem PL13.7.2 shall be the meter of each size of pipe grouted.

The tendered rates shall include full compensation for all plant, material and labour necessary for carrying out the work as specified.

Item		Unit
PL13.8	**Timbering and shoring left temporarily in the thrust and reception pits and pipe boring pits**	week

The unit of measurement shall be the number of weeks during which the timbering and shoring is left in position for another contractor to construct manholes, etc, under a separate contract.

This item will only apply where the jacking and boring work is carried out under a separate contract or under a nominated subcontract.

The tendered rate shall include full compensation for the removal of the timbering and shoring by the pipe-jacking or pipe-boring contractor when it is no longer required and within one week of having been instructed to do so by the Engineer, in writing.

PM PARTICULAR SPECIFICATION: PUMPS, PIPEWORK AND ANCILLARY EQUIPMENT

Sections 1 and 2 of this Specification shall be read in conjunction with the accompanying Scope of Contract and Project Specification.

PM 1: TECHNICAL SPECIFICATIONS : MECHANICAL EQUIPMENT

1.1 DESIGN

GENERAL

The workmanship shall be of the highest quality throughout. All materials and workmanship, which may, in the opinion of the Engineer, be inferior to that specified for the work will be condemned. All condemned material and workmanship must be replaced or rectified, as the case may be, at no cost, to the satisfaction of the Engineer.

In his design calculation, the manufacturer shall make provision for the worst possible conditions that may have to be withstood by the plant, whether during operation or during fabrication, transport or erection.

1.1.1 Design

1.1.1.1 Permissible stress

"Normal permissible stresses" in steel: 50% elastic limit.

"Exceptional permissible stress" in steel: 75% elastic limit.

In the case of a component subjected to stress in several directions, the equivalent permissible stress will be equal to the "exceptional permissible stress".

1.1.1.2 System of units

The system of units adopted for the design studies, manufacture, erection works and tests is the international metric system (S.I.) with corresponding symbols (See I.S.O. 1000).

1.1.1.3 Interchangeability

All similar parts of the plant shall be interchangeable without recourse to additional machining or fitting.

1.1.1.4 Handling and dismantling ability

All heavy components designed to be dismantled and handled shall be provided with the following:

- rings, lugs, collars for lifting,
- slings, chains and special tools for handling,
- special lifting screws, fitted at selected points and in sufficient numbers, for components designed to be uncoupled.

The facilities described above are part of the Contractor's supply.

1.1.1.5 Access for concreting and grouting

All parts to be embedded or anchored in concrete shall when necessary be designed with sufficient access to allow easy and efficient concreting around the part.

In order to allow easy alignment of pump and motor after grouting, side screws shall be provided on the foundation steelwork in the case of horizontal pumpsets.

1.1.1.6 List of Standards

The equipment shall comply with this Specification and with the current and most recent edition of whichever of the following standard specification is relevant:

- South African National Standards (SANS)
- American National Standard Institute (ANSI)
- American Petroleum Industry standards (API)
- American Society of Mechanical Engineering standards (ASME)
- American Society for Testing and Materials standards (ASTM)
- British Standards (BS)
- French Electrical Standards (UTE)
- German Standards Institute (DIN)
- International Electric Commission (IEC)
- International Standards Organisation (ISO)
- Japanese Industrial Standards (JEM)
- Swedish Standards (SIS)

No other standards may be used until they have been approved by the Engineer.

Should conflict occur between the South African and any other of the above standards, the former shall apply.

Among standards, which are to be applied to almost every part covered by this Specification, the following should be noticed:

BS	4360	Specification for mild steel for general structural purposes;
BS	1452	Specification for grey iron castings;
SANS	719	Electric welded low carbon steel for aqueous fluids (Grade A). (The sampling procedure outlined in Clause 6.1 of SABS 719 is hereby waived.)
SANS	1123	Flanges to suit design pressures.
BS	2633	Welding of specials rated to 2,5 MPa and higher (Class I).
BS	2971	Welding of specials rated to less than 2,5 MPa (Class II).
SANS	1700	Fasteners
BS	3601	Steel tubing rated higher than 1,72 MPa.
BS	1387	Steel tubing rated to 1,72 MPa.

The particular requirements of this Specification shall take precedence over any of the standard specifications referred to throughout the Specification.

The standards, which will be applied shall be explicitly stated in the tender offer.

1.2.1 Materials

1.1.2.1 General

All materials shall possess qualities adequate for the purpose for which they are to be used. All materials and properties claimed for these materials shall, unless specified otherwise in this document, comply with the requirements of the most recent edition of the appropriate South African or other internationally recognised standard specification.

For each type of equipment, the Manufacturer shall indicate the materials used for each of the proposed sub-assemblies.

The equipment shall be manufactured using new prime quality materials taking into account the latest technical innovations.

All components shall have a surface finish in relation to their importance, their position and their intended purpose.

Rolled steels and all castings shall be clean and free of blisters, porosity, shrinkage, holes, cracks or other flaws, which may be detrimental to their use.

1.1.2.2 Castings

Before proceeding with the manufacture of cast components, the drawings of all main cast components showing the location of samples to be taken for mechanical and chemical tests shall be submitted for the Engineer's approval.

The Manufacturer shall inform the Engineer of the date when the components are to be cleaned. Blisters and other flaws that may be revealed during cleaning or machining shall be carefully ground to clean metal before undertaking any repair.

No repair of cast components will be permitted without the prior approval of the Engineer.

The filling of casting defects shall be carried out by highly qualified welders only, according to the latest welding techniques.

Any cast component requiring filling at any fabrication stage after the first anneal shall be subjected to further annealing treatment unless stipulated otherwise.

Cast components shall not be warped or distorted in any way and shall not show any increase in dimensions (beyond that shown on the fabrication drawings) likely to cause interference with other components in the erection of the item of equipment for which they were made. The structure of cast components shall be homogeneous and free of non-metallic impurity. If, at critical points of a cast component, there is too great a concentration of impurities or alloy, the component shall be rejected.

1.1.2.3 Stainless steels

The stainless steel used shall be of the type easily jointed or filled by electric welding. Stainless steel, which cannot withstand the effects of welding or associated heat treatment, will not be accepted.

1.1.2.4 Fasteners

All high tensile bolts and studs used shall bear the letters HTS stamped or engraved on the end. Washers shall be provided under all bolt heads and nuts. The threads of bolts and studs shall be cleaned and coated with a graphite/grease compound before assembly. The threads of all bolts and studs used with the equipment supplied shall be to the same standard.

1.1.2.5 Welding

Fabricated components

The preparation and welding of fabricated components shall be in accordance with BS 5135 and no departure from this specification shall be permitted without the prior approval of the Engineer.

Test Pieces

The Contractor may be required to submit weld test samples, in accordance with BS 4872 completed by each and every welder nominated to work on the fabrication of components.

The samples will be tested by the Engineer or approved Contractor and the welders of substandard specimens will be precluded from working on specified items.

Each sample shall be clearly marked with the operator's name and the name and address of his Employer.

Tests

The completed fabricated parts shall be subjected to a visual test and a random magnaflux test. The welds shall, for test purposes, be in a clean and well wire brushed condition.

The random magnaflux test shall consist of approximately 10% of the total weld length. Should more than 20% of the total tested length of weld be found to be defective then 100% testing using the magnaflux method, shall be carried out on all welds. Acceptability of welds will be judged in accordance with API 1104.

The Contractor shall keep the Engineer informed regarding the progress of fabrication in order that these tests may be carried out during construction and prior to any painting or further assembly work.

In order to assist the Engineer in selective testing of welds, the Contractor may be required to submit sketches or lists giving the approximate length, type and method of weld to be used.

Approved Subcontractor

The Engineer reserves the right of approving the Subcontractor to carry out the weld tests and the Contractor shall consult with the Engineer at an early stage regarding a suitable Subcontractor.

Cost

The cost of all tests, including the provision of the necessary equipment, shall be stated in the space provided on the Price Schedule.

1.2 CORROSION PROTECTION

1.2.1 Responsibility

It shall be the responsibility of the Contractor to paint all plant and equipment supplied under this Contract, with the exclusion of the items, which do not require coating as defined hereinafter.

The responsibility of the Contractor covers all his equipment, painted or not painted, regarding corrosion resistance.

Any deviation from the following detailed requirements is to be clearly defined in the Tender. Unless so defined, no departure from this Specification will be allowed even for parts, which may be considered as accessories (e.g. drive guards, foundation steel work, etc.)

1.2.2 Design

1.2.2.1 General

Bearing, rolling or rubbing surfaces shall be constructed from corrosion resistant materials. Dissimilar metals in contact producing a potential difference exceeding *0,3 Volt* on the galvanic series of metals and alloys in seawater shall either be insulated from each other or when a corrodible metal is welded to a corrosion resistant metal, the protective coating shall overlap onto the latter by at least 10 mm.

All copper alloys shall be zinc free.

Crevices shall be avoided whenever possible, or steps shall be taken to seal them when unavoidable. Blemish marks shall be filled and smoothed over before the application of the final external enamel coating, to achieve a pleasing effect.

Retention areas in water passages that may hold water, mud, leaves, debris, etc., shall be avoided.

1.2.2.2 Fasteners

- Fasteners used in the internals of assemblies, in waterways, valve chambers, wet-wells or in areas which are inaccessible after assembly and/or installation shall be constructed from a suitable grade of stainless steel.

- Fasteners used "in the dry" and which are easily accessible shall be constructed of either stainless steel or mild steel protected by means of hot dipped galvanising:

The thickness shall be 18 to 20 microns.

- Fasteners used as hold-down bolts for equipment, or for pipe joints, pump exterior or on the crane, within the Pump Station building, may be constructed from untreated mild or high tension steel as required, the exposed portions subsequently to be coated together with the associated equipment.

Methods of preparation and application of coatings on proprietary or stock items procured ready for installation by the Contractor shall meet with the approval of the Engineer. Details of materials and procedures, shall be provided together with the Tender offer.

1.2.2.3 Manifold and other pipes to be welded in situ

- These pipes will generally be concrete encased in situ by the Civil Contractor. This means that the external surfaces of the pipes shall be prepared as defined hereinafter after welding and prior to encasement.

The full specified coating shall however be applied to the external surfaces of pipes where they protrude from concrete to air, for a distance of at least 100 mm into the concrete. When directed by the Engineer, the concrete/steel pipe interface fillet shall be caulked with suitable approved mastic.

- The internal surfaces shall however be factory coated to the Specification leaving 100 mm uncoated at the to-be-welded ends.

- It is required that after the site-welds have been made; the full Corrosion Protection Specification shall be applied and tested.

1.2.2.4 Extent of coating required

Unless explicitly otherwise specified (e.g. for some kinds of fasteners) all surfaces of plant and equipment shall be coated, including both inside and outside of puddle pipes.

Nevertheless, all non-corrodable parts do not require coating. Pumps, which are made of a material, which can be considered as non-corrodable with regard to the quality of water to be handled may not require internal corrosion protection. This shall be clearly specified in the Tender, as well as the proposed non-corrodable material.

Labels and components where painting would adversely affect the operation or legibility shall not be painted.

Surfaces of all corrodible components which will normally come into contact with hydraulic fluid, oil or grease need not be painted but shall be free of rust and scale and be thoroughly clean.

1.2.3 Surface preparation for all coatings

1.2.3.1 Important remarks

- Mechanical pre-preparation as well as blast cleaning are required for all painted surfaces unless otherwise explicitly specified.

- In the case of all wetted surfaces, the surface preparation will follow the satisfactory completion of any tests and inspections carried out on bare pipes, valves and pumps.

1.2.3.2 Mechanical pre-preparation

- Welds shall be smooth and free from undercuts, protrusions and sharp edges that may protrude through the coating. Weld spatter, slag and loose scale shall be removed and sharp edges ground to a radius.

- Deposits of oil, bitumen, coal tar or other contaminants shall be removed by scraping and final wiping with a rag soaked in white spirit.

1.2.3.3 Blast cleaning

- Blast cleaning shall be carried out in accordance with clause 4.3 of SABS C.O.P. 064.

- Cleanliness grades required: ISO 8501-1:

  (a) For metal spraying or epoxy coatings: SA 3.

  (b) All other coatings: S.A. 2½.

- Blast cleaned profile required:

  (a) For metal sprayed surfaces (grit blasting only permitted) : 50-100 microns.

  (b) For Epoxy and all other coatings : 75 microns max.

- Laminations, scales and occluded scale, which become visible after blast cleaning, shall be ground out, after which the area shall be blast cleaned once again. If such grinding penetrates deeper than 7% of the metal thickness, the area shall be repaired by welding or the metal shall be rejected at the discretion of the Engineer.

- Occluded grit and hackles shall be abraded off. Dust and debris from blast cleaning shall be removed prior to coating to achieve a residual dust and debris level not exceeding 0,1% when determined by SABS Method 769.

Special cases

- The external surfaces of steel pipes to be encased in concrete shall be:

  (a) abrasive blast cleaned;

  (b) coated with epoxy coat to DFT 175-200 microns.

- The external surfaces of steel pipes to be buried in soil shall be thoroughly wire brushed prior to being treated as specified in clause 1.2.4.4.

- Copper tubing and sections of pump and motor shafting exposed to air shall be thoroughly cleaned to a bright finish and covered with an oil resistant lacquer.

1.2.4 Coating Materials and Application

1.2.4.1 Epoxy

- Internal wetted surfaces of all pumps, pipes, specials and valves, and the exterior of all pipework and equipment mounted in underground chambers (valves, venturi elements etc.) but excluding non-corrodible surfaces where painting would adversely affect the operation of the equipment, shall be epoxy coated with an approved epoxy.

- Various acceptable application methods are specified hereafter.

- Epoxy paint containing coal tar will not be acceptable.

1.2.4.2 Epoxy and polyurethane top coat

- All surfaces of pipework and equipment normally exposed to air and located within the main body of the Pump Station shall be coated with an approved epoxy coat and recoatable polyurethane finish.

- After surface preparation, one coat of an approved epoxy shall be followed by one coat of an approved recoatable polyurethane finish before dispatching from the Works. One further finishing coat shall be applied after erection on Site.

1.2.4.3 Galvanising

- Internal wetted surfaces as well as surfaces exposed to air may be galvanised in accordance with SABS ISO 1461 and SABS EN 10240.

- Surfaces to be galvanised shall first be degreased.

- Galvanised surfaces shall receive an etching primer of zinc oxide to SABS 910 or calcium plumbate to SABS 912 before one coat of universal undercoat and two coats of an approved enamel paint are applied.

- All threads that are cut in galvanised pipe shall be coated with a suitable rust preventive compound immediately after cutting and before assembling the pipework.

- Galvanised surfaces, which are damaged during transport or erection shall be repainted with an approved cold galvanising process. Aluminium painting will not be acceptable.

1.2.4.4 Steel pipes buried in soil

- The external surfaces shall be thoroughly wire brushed, primed with a suitable petrolatum tape primer and followed with at least one layer of an approved petrolatum tape (Densotape or equal). This shall be followed by a further layer of PVC tape wrapping with not less than 50% overlap.

1.2.4.5 Electrical equipment

- Transformers shall be coated in accordance with SABS 780.

- Electric motors and regulators shall be coated in a manner in keeping with the high standard of this Specification and shall be acceptable to the Engineer. Details of materials and procedures shall be provided together with the Tender offer. Baked enamel finishes will be preferred.

- Control consoles and switchgear panels shall be baked enamel.

1.2.5 Application of Epoxy Protective Lining

The directions laid down by this Specification and the paint Manufacturer for the mixing and curing, the application of solvents, the permissible working air temperature and humidity, overcoating times and dry film thicknesses shall be strictly adhered to. Certified records of material and operation shall be kept and produced for inspection when required by the Engineer.

Blast cleaned surfaces shall be coated as soon as possible after completion, inspection and approval of the surface. The time interval between cleaning and coating shall in any case not exceed the following:

- 4 hours when relative humidity is below 70%

- 2 hours when relative humidity is between 70 and 85%

Coating shall not take place when the relative humidity exceeds 85%, nor when the steel temperature is less than 2°C above dew point.

Each coating shall be uniform, smooth and glossy. The application shall be free of all tears, runs, sags, wrinkling, bubbles, blisters, pimples, spikes, orange peel, pinholes, holidays or dust particles.

Flange faces shall be treated on the machined surface with a film thickness not greater than 90 microns. Other parts of the flange and especially the throat, shall be treated with the full system. All crevices shall be sealed with an approved water resistant sealer.

All internal site-welded joints shall be made good (i.e. mechanical pre-preparation and blast-cleaning) and the entire internal surface shall be retested for thickness and pinholes to the Specification.

The Tenderer may quote for any of the following systems, indicating in his Tender, which system is offered:

- Epoxy powder applications: One coat. Dry film thickness shall be not less than 400 microns for linings and 300 microns for coatings. Handling of coated equipment is not permitted within 8 hours of completion of the coating.

- Solvent-free epoxy application: One or two coats. Each coat shall be a different colour from the previous coating. Total dry-film thickness shall be not less than 400 microns for linings and 300 microns for coatings. Handling of coated equipment is not permitted within 16 hours of completion of the coating.

- Solvent-borne high-build epoxy application: Minimum of 2 coats, each coat shall be a different colour from the previous coating. Thickness of any one coat shall be not less than 85 microns nor more than 150 microns. Total dry-film thickness of both linings and coatings shall be not less than 300 microns. Handling of coated equipment is not permitted within 7 days of completion of the coating.

NOTE:

All coating thicknesses shall be measured by means of an approved calibrated eddy-current instrument within 72 hours of the final coat being applied.

The above requirements apply to both Shop as well as Site applications of epoxy linings including site-repaired coatings.

1.2.6 Handling and Transportation of Painted Items

Coated components shall be handled with due regard to the relatively soft nature of organic coatings and appropriate precautions shall be taken. The use of ropes, wire ropes or chains, without suitable padding, is expressly forbidden. Balks of timber shall be used to support the components on soil, concrete or other hard surface and to separate items from each other. When loading onto vehicles, precautions shall be taken to support and chock the components to prevent movement. Components shall be firmly lashed or chained with padded lashing, supported on sawdust bags. The area of padded surfaces shall be adequate to prevent damage to the coating.

In order to protect the internal coating system of pipes, specials and valves, open ends are to be completely blanked off by sturdy blank flanges, not just plastic sheet alone, and are to be clearly marked:

"DO NOT REMOVE UNTIL FINAL INSTALLATION"

Plastic sheeting alone will not be acceptable.

Items will be inspected on arrival at the Contractor's end-delivery point and any repairs necessary shall be at the cost of the Contractor. Such repairs shall comply with all requirements of this Specification.

1.2.7 Finishing Coats

1.2.7.1 Colours

In general, the colours as recommended in SABS code of practice 0140 part III for identification colour marking shall apply. Identification colours shall be painted completely or in bands as required in clause 6.1. of SABS code of practice 0140 part III as directed by the Engineer, with particular emphasis on pipework.

Individual Supplier's usual colours will be considered for proprietary items.

The following system and/or safety colours are preferred and cannot be changed without the Engineer's agreement in writing:

- Pumps and main valves : Middle Blue in accordance with BS 381-C-109, CKS D.37 or SABS 1091 - F 07.

- Motors : Light Beige in accordance with SABS 1091 - C 57.
- Pipework and minor valves : Arctic Blue in accordance with BS 381-C-112 or SABS 1091 - F 28.
- Switchboards and cubicles : Orange in accordance with SABS 1091-B26.
- Control consoles : Outside : Eau de Nil in accordance with SABS 1091-D43

  Inside : White
- Baseplates : Black
- Valve handwheels : Golden Yellow in accordance with SABS 1091 - B 49.
- Machine guards : Signal Red in accordance with SABS 1091 - A 11.
- Protruding equipment and/or hazardous overhead structures shall be painted with golden yellow/black chevrons to attract attention.

Other external final colours of the main plant and any other equipment, which have not been specified, shall be decided by the Engineer after discussion with the Contractor.

1.2.7.2 Appearance

- Particular attention shall be given to the exterior finish of all visible plant. Special consideration shall be given to produce a neat arrangement convenient and easily accessible for cleaning. Baked enamel finishes with chromium plated, stainless steel or brass trim when applicable are preferred.
- All damaged coatings of installed equipment shall be made good to the original Specification. Full additional finishing coats may, if justified, be required by the Engineer.

1.2.8 Inspection

1.2.8.1 Inspection by the Contractor

The minimum inspection to be carried out by the Contractor shall be that which is necessary to ensure compliance with all clauses of this Specification, since he will be held responsible for non-compliance in any respect and shall be required to repair any defect to the satisfaction of the Engineer.

1.2.8.2 Inspection by the Employer

The Engineer has the right to inspect any item covered in the Contract, and may appoint either the SABS or other alternate inspection body to act on his behalf.

It is required that due notice be given to the Engineer of impending cleaning and first coat operation in regard with the painting of the main equipment, as well as for witnessing final coating thickness and pinhole detection tests.

All the tests shall be carried out by the Contractor at his own expense and in the presence of the Engineer or his appointed Representative and to his complete satisfaction. The Employer reserves the right to appoint the SABS or other inspectorate to inspect the epoxy linings on his behalf and at his own expense over and above the Contractor's routine inspection.

1.3 INSPECTION, TESTS AND ACCEPTABILITY

1.3.1 Quality Assurance

1.3.1.1 Quality system requirements

Definition

The quality system requirements are those specified in ISO 9002:1987 (or SANS 0157 - Part II): "Quality Systems - Model for quality assurance in production and installation".

This international standard shall be used for external quality assurance purposes when a contract between two parties requires demonstration of a supplier's capability to control the process that determines the acceptability of the product supplied.

Subcontractors (ISO 9002 - 4.5)

Subcontractors not covered by an approved make shall meet the same quality requirements as the main Contractor.

If a Subcontractor does not have the ability to provide all the services specified (see clauses Data books and Quality plans), these may be supplied by the quality system of the main Contractor. The main Contractor remains responsible for the quality requirements of the Contract as a whole.

The Quality System Questionnaire included in these documents shall be completed by the Tenderer (compliance with ISO 9002 or SABS 0157 - Part II)

Data books (ISO 9002 - 4.15)

A typical data book should comprise the following:

Section I : Technical specification

Section II : Drawings/Specification schedules

Section III : Quality plans

Section IV : Work instructions

Section : Personnel certification (Welding procedure qualification, etc.) Section VI: Material certification (Heat treatment records, etc.)

Section VII : Check-lists and releases

Section VIII : Concessions/Deviations

Section IX : Customer releases/waivers

Section X : Unpriced copy of suborders

This arrangement is not compulsory and the Contractor may use a standard table of contents.

A separate data book shall be issued for each important part of the equipment, e.g:

- Pumps
- Motors
- Control valves
- Inlet and delivery isolating valves
- Monitoring and control equipment

A data book shall be compiled for all valves made on order, which are not covered by SABS approval or a standard certificate.

Data books shall be compiled in accordance with the progress of manufacture and shall be kept at the Engineer's disposal.

One final copy of the above shall be issued immediately following on the Acceptance Tests.

Quality plans (ISO 9002-4.9)

A standard form of quality plan shall be attached to the tender offer.

After award of the Contract, detailed quality plans with sufficiently detailed drawings shall be submitted to the Engineer for approval.

The quality surveillance of the Contract will be carried out by the Engineer/Employer or by an external Quality Surveillance Authority to be designated not later than one month after date of order.

Contractors shall make available for inspection their internal Quality System Manual, their Standard Procedure Manual and their Work Instructions.

1.3.2 General

1.3.2.1 General acceptability – background and costs

Inspection and tests required of the Contractor include the tests and inspections in the workshops and the inspections and tests at Site.

Depending on the results of the tests and inspections, penalties may be applied and, in certain cases, part of or all of the equipment may be rejected, as set out hereinafter.

The cost of all tests and inspections shall be included in the Tender. For instance, the cost of commissioning and testing at Site shall be included as part of the cost of erection. (Except for the cost of power and water consumed.) No claim for travelling expenses or further time required for testing will be allowed.

Wear

- Tenderers shall fully acquaint themselves with the properties of the water to be pumped. Any wear of portions of the pump or ancillary equipment that will affect its operating efficiency during the Period of Maintenance will result in the pumpset being rejected. (See Project Specification for details.)
- Signs of cavitation pitting on pump parts will not be acceptable.

- All moving parts shall be properly lubricated and protected against shocks. Visible wear of any such parts during the Period of Maintenance will not be acceptable.

Tightness

- Leakage from any oil, water or air circuit will not be acceptable.

- Leakage at the glands shall be controlled to the minimum required and drained to the Pump Station sump.

- Provided there has been no physical damage to the seat, valves shall be droptight under working pressure at the end of the Period of Maintenance. (See Clause 1.3.4.3)

Vibration

- Operation of pumps and valves shall be free of vibrations throughout the full range of normal running conditions of the Pump Station.

Temperature rise

- In no case shall temperature-rise above the ambient temperature reach or exceed 40°C for any mechanical component. For temperature-rise of bearings see Clause 2.1.7.4.

1.3.2.2 Tests and inspections

Within three months after the date of receipt of Order (after acceptance of the Tender), the Contractor shall submit to the Engineer or his Representative for approval a detailed schedule of the tests to be performed both in the workshops and on Site. This schedule shall cover all pieces of equipment and instruments supplied under this Contract. It will detail the following:

Inspection and tests in the workshops or in a recognized test laboratory, such as the SABS in Pretoria

- raw material quality control tests,

- parts or instruments,

- sub-assemblies,

- complete assemblies,

- pressure tests,

- performance tests including vibration tests.

Inspection and tests on Site

- tests before starting the pump sets, i.e. before initial commissioning;

- Acceptance Tests, including pumpset performance and NPSH tests, vibration analysis and cavitation tests;

- tests to be performed at the end of the Period of Maintenance.

The Engineer will notify the Contractor which tests and inspections he will attend.

All results of measurements taken during the tests shall be recorded. These results, together with the information listed above and the appropriate comments will form the test report that the Contractor shall submit in duplicate to the Engineer within two weeks after the date of completion of the test.

The Contractor's representative on the Site shall make available on request all reports concerning tests or inspections performed under this Contract. He shall have available on Site during any test the full technical data, including curves, of the plant supplied or installed.

The tests results shall also appear in the Operation and Maintenance Manuals (see Clause 1.4.5.3 - Contents). For instance, regarding the vibration measurements, the highest levels actually measured at the bearings will be recorded, as well as the highest permissible levels.

1.3.2.3 Tests reports and certificates

In the case of routine tests concerning standard equipment or material quality control tests, not attended by the Engineer or his Representative, tests reports or certificates in duplicate shall be submitted to the Engineer within two weeks.

For all major tests attended by the Engineer or his Representative, the Contractor shall submit well in advance i.e. at least two weeks before its performance, a detailed programme of the test.

This programme shall include:

- the testing method and procedure,
- the description of the test rig or bed,
- the exact location of measuring probes and sensors,
- the characteristics and calibration records of the measuring instruments,
- the preliminary results of the tests already performed, all tests certificates, X-ray films, dimensional controls, concerning the piece of equipment tested.

1.3.3 Inspection and Tests In The Workshops

1.3.3.1 General requirements

In addition to the material quality control tests, dimensional checking procedures or routine tests on parts or standard pieces of equipment that the Engineer will not usually attend, each completed piece of equipment shall be assembled in the factory, inspected and tested, the Engineer or his Representative attending or not.

The Contractor shall notify the Engineer or his Representative in writing two weeks in advance, of the place and dates at which the equipment may be inspected and tested.

The Engineer or his Representative will inform the Contractor of his intention to attend the test or the inspection and propose a date, which suits him. If the date preferred by the Engineer is later than ten days after the first possible date, the Contractor shall be entitled to perform the test or inspection without the presence of the Engineer.

If on any agreed date the equipment to be inspected or tested is not ready and the test or inspection has to be postponed the Contractor shall be held responsible for the travelling and/or living expenses of the Engineer and/or his Representative.

When tests and inspection have met the satisfaction of the Engineer or his Representative a certificate of Workshop Acceptance will be issued by the Engineer. The Contractor shall not pack and dispatch to Site any equipment before receiving the relevant "Certificate of Workshop Acceptance."

1.3.3.2 Hydrostatic pressure tests

All pieces of equipment subject to water, oil or air pressure shall be tested at a pressure not less than one and one half times the design pressure. For the main pipework, the design pressures are specified in the Project Specification and on the drawings.

Each piece shall withstand the hydrostatic test pressure without exhibiting signs of sweating, undue deformation and stressing, or defect of any kind. Should any such defect be discovered during testing, the defective component shall be indelibly marked for easy identification and treated as per “defective welded steel pipes and specials” below.

Hydrostatic testing shall be done with blank flanges bolted on the flanges of the piece. The use of tie-bolts or other forms of restraint applied across the blank flanges to restrain the bodies from deflecting under the applied test pressure will not be permitted without the Engineer's approval.

The hydrostatic test pressure shall be maintained for a period of at least 10 minutes, during which period the vessel shall be smartly and repeatedly struck with a steel hammer of approximately 1 kg.

The butterfly, control, reflux or sluice valve doors shall be left partially open for the body proof-tests. The valve bodies shall be watertight at test pressure.

Gate proof-tests shall be carried out on the reflux, butterfly, sluice and control valves by bolting a blank flange to one side of the body and applying the test pressure between the blank flange and the gate. The other side of the gate shall be open to the atmosphere. This test shall be carried out on both sides of the gate (except for reflux valves). Complete water tightness at valve seat faces will not be required under gate proof-test conditions, (i.e. at the test pressure, which is 1,5 the design pressure,) but similar tests to those described for the gate proof-test are to be carried out subsequently at the design pressure and the valves shall be water tight in this case.

Pipe specials

All flanged specials shall be hydrostatically pressure tested and all other bends and specials shall as far as is practicable be tested, in the same manner as straight steel pipes.

In the case of specials not suitable for hydrostatic testing, 100% of all welding shall be examined radiographically and shall comply with API 1104 (in case of dispute, the interpretation of API standard 1104 by the South African Bureau of Standards shall be final and binding). Should welds not be able to be examined radiographically, dye penetrant testing, as set out below, will be allowed subject to the approval of the Engineer.

Dye penetrant testing to ASME V

Where applicable (refer “pipe specials” above), liquid dye-penetrant testing shall be done in accordance with ASME V article 6.

Defective welded steel pipes and specials

Pipes which show leaks or defects shall be rejected, but the defect may be made good by the Contractor at his own expense and such pipe special submitted for re-test. The only permissible method of repair shall be by removal of the defective material and re-welding.

A record shall be kept of the date of test, the serial number of the pipe and the test pressure.

1.3.3.3 Other tests (please refer to Clause 1.2.8)

Inspection of coatings

Tests shall include measurement of the following:

Final coating thickness; pinhole detection; paint bonding tests: Paint film to substrate bond-tests shall also be executed. The Tenderer shall furnish details of what tests he proposes to use together with his tender offer.

Testing the rotating elements of pumps and motors

All rotating elements shall be dynamically balanced. After the completion of the balancing procedure, results of the tests shall be submitted to the Engineer.

1.3.3.4 Electrical motor tests (please refer to Clause 1.2.8)

All motor tests shall be in accordance with SABS 948, BS 4999 and BS 5000.

Type tests shall have been witnessed by an approved authority.

Type test certificates will only be acceptable for production motors less than 300 kW, at the discretion of the Engineer.

Routine tests

Each motor shall be tested at the Manufacturer's works for light-run, locked rotor, insulation resistance, high voltage and air-gap clearances.

Performance tests

Each motor shall be tested at the Manufacturer's Works for temperature rise and excess torque in terms of BS 4999.

The measurement of the temperature rise of the stator windings of motors shall be by the increase in resistance method.

Test certificates

Test certificates in duplicate, showing the results of all tests performed, shall be supplied at a date not later than the delivery date of the motors.

The test certificates shall contain power factor and efficiency figures for 100%, 75%, 50% and 25% of full load conditions as calculated from the test results.

Witnessing of tests

All type and routine tests on motors larger than 300 kW (or less, if agreed otherwise, at the discretion of the Engineer) may be witnessed by the Engineer or his Representative. Two weeks' notice shall be given in each case.

Testing of terminal box assembly

Proof shall be given to show that a prototype terminal and cable box assembly of the type being supplied on high voltage motors has been tested under internal short circuit conditions and that the pressure relief diaphragm ruptured protecting the case of the terminal box from serious damage.

In addition, proof shall be given that a through-fault current test was made to demonstrate that the complete assembly is capable of handling the short circuit current without damage. The fault current of these tests shall have been 45 000 Amp for a duration of 0,25 seconds.

1.3.3.5 Pumpset tests

Performance tests

Each pump complete with its driving unit shall be tested at the Manufacturer's works, or other location approved by the Engineer to "Class B" requirements of BS 5316 Part 2, and the efficiency carefully measured. Variations from the actual running conditions of the pumps are allowed as defined in the standard. Unless otherwise explicitly mentioned, cavitation tests are required at works.

The tests shall be witnessed by the Engineer or his Representative and details of the tests and the results obtained, duly signed by the appointed Witness, shall be submitted to the Engineer before despatch of the pumping units from the Manufacturer's workshop.

Vibration tests

The rotating element shall be dynamically balanced before pump assembly. The good balance of the whole pumpset will be checked by measuring the absolute vibration of pump and motor bearing housings.

Tests shall be performed with the pumpset on sound foundations, similar to those expected at Site.

Measurements shall be taken in the three axes at each bearing, i.e. axial and two radial components at right angles to each other.

The maximum peak-to-peak displacement for both pump and motor shall in no case be higher than that allowed for motors according to BS 4999: Part 50. These maximum values are summarised hereinafter (see Clause 1.3.4.2 “vibration tests”).

Performance and vibration tests as described above are to be performed before installation on Site for all pumpsets more than 22 kW. If these tests are impractical or impossible at the pump manufacturer's works, Tenderers must state this in their Tender and explain the reasons why it is so. The Engineer may be prepared to consider alternative proposals for testing provided these proposals are submitted with the Tender and are clearly described and defined. If this is not done, the Tender will be penalised for the cost necessary to have the tests performed in another workshop.

1.3.4 Inspections and Tests at Site

1.3.4.1 Initial commissioning

Purpose

With regard to the Initial Commissioning, as described below in Clause 1.4.4.4 the Contractor shall make sure that the installed equipment can be run satisfactorily for the period required (not less than two months) before the Acceptance Tests can be performed and especially that it can be run safely as far as personnel, the equipment itself and adjacent equipment which is not included in the Contract is concerned. He shall satisfy himself, before proposing a date for the Initial Commissioning that his equipment and all other associated equipment (i.e. high tension switchgear, earth, civil works, etc.) is in a proper condition to allow the running of the pumpsets in a safe and satisfactory condition. In particular, proof shall be given that all the equipment has been hydraulically tested at Site.

Work to be performed

The pumpsets shall be run without interruption separately for at least 4 hours or such further time as may be required to reach stable operating conditions (particularly, motor temperatures shall be stable).

If the prescribed duration cannot be achieved, the Initial Commissioning shall take place at a date to be agreed upon by the Contractor and the Engineer. It is to be borne in mind that the penalties for late delivery shall be linked with the Initial Commissioning.

During the test, every 10 minutes, the following readings shall be taken:

- indications of all meters (flow, pressure, power, etc.);

- indications of all monitoring devices (temperatures at bearings and windings, vibration, etc.)

These readings shall be recorded in a report to be signed at Site by all parties involved.

Partial Initial Commissioning

Initial Commissioning may be performed for only a part of the equipment if requested by the Contractor and agreed to by the Engineer, or if there are different target dates to be met. When the last pumpset has been commissioned, the duty pumpsets shall be operated for a period of not less than two hours at full load.

Responsibility and Period of Maintenance (Defects Liability Period)

The responsibility of the Contractor concerning his equipment is in no way alleviated by the Initial Commissioning, which does not start the Period of Maintenance (or Guarantee Period either), as described below in Clause 1.4.4.6.

Preliminary Operating and Maintenance Instructions

At the time of Commissioning, the Engineer shall have received a draft Operating and Maintenance Manual and preliminary operating instructions (which may be extracted from the draft manual) shall be handed to the Client's Operations Staff in the presence of the Engineer when commissioning. From then on the Contractor must satisfy himself that the plant can be operated safely even when his staff are not on Site.

1.3.4.2 Acceptance tests

Performance tests

The Acceptance Tests on Site shall be carried out not less than two months after initial commissioning of the whole plant. If the items of plant have been run for less than 200 hours each, the Engineer's approval shall be obtained before the date of the Acceptance Tests is fixed. The Contractor shall supply all necessary calibrated instruments to measure the suction and delivery pressures, rates of flow, the electrical power input to the motors, the speeds of the units and sufficient competent personnel to carry out the tests.

Test results shall be included in the Operating and Maintenance Manual (see Clause 1.4.5.3 "contents").

Flow rates shall be determined from the rising main metering device provided by the Contractor. Alternative methods may be proposed in the Tender, a volumetric method being obviously more reliable than the use of any flow meter.

Performance tests shall conform to BS 5316: Part 2, i.e. to Class B tests and the test meters used shall provide the required accuracy. The following tables are applicable:

- Table 4: Maximum permissible amplitude of oscillations as a percentage of mean value of quantity being measured.

- Table 5: Limits of variation between repeated measurements of the same quantity.

- Table 6: Permissible systematic errors of measuring instruments.

Maximum limits of overall error stipulated in table 7 of BS 5316 part 2 is superseded by this Specification.

All test equipment's shall have been previously calibrated. If either party insists on a recalibration of any item of equipment, then the cost of the re-calibration shall be borne by that party if it is found that the instrument did not require re-calibration.

The efficiency of the motors shall have been established previously in factory tests (see Clause 1.3.3.4).

Tests for each pumpset shall be conducted as follows: Two readings as close to the specified duty point as is practically possible in order to determine compliance with the guarantee, one on either side of this duty point; thereafter further tests shall be conducted at various duties between zero flow and maximum possible flow to verify the pump characteristics and compliance with the specified requirements.

Cavitation and net positive suction head

A cavitation test as specified in BS 5316: part 2 shall be carried out. The test procedure intended shall be indicated in the tender offer. The simple test described in paragraph 7.1.1.1. of the standard, i.e. a performance test carried out at the specified NPSH to show that the pump is sufficiently free of cavitation at the specified duty may be acceptable with the Engineer's approval.

As an exception to BS 5316 Part 2, paragraph 6.2.2. ("Pressure tappings"), the location of the pressure tappings shall be located at least as defined in the standard and sited as far as possible from the pump flanges. A measure of the overall efficiency of the Pump Station is preferred, i.e. including the losses due to valves upstream and downstream of the pumpsets, as called for in the Project Specification.

The results of the performance tests shall be computed on Site and compared with the tendered performance figures and the previous tests performed at Works. In the event of any unexplained inconsistency the tests shall be repeated forthwith.

With the Engineer's agreement, the performance tests may be repeated if, having been performed in satisfactory conditions, the tendered characteristics (efficiency, flow, etc.) are not met. In this case, the Contractor will have to show that the results obtained in the repeated tests have improved in comparison with the previous ones as a result of more accurate readings having been taken.

Vibration tests

Vibration tests are to be carried out on Site, preferably at the same time as the other Acceptance Tests.

(a) Displacement amplitudes (up to 150 kW)

The absolute vibration of pump and motor bearing housings is to be measured.

The measurements will be taken in the three axes at each bearing, i.e. axial and two radial components at right angles to each other.

The maximum peak-to-peak displacement shall in no case be higher than that allowed for motors according to BS 4999: Part 50. These maximum values are summarised in the following table for the usual rotation speeds for both shaft and thrust bearings on pumps and/or motors.

Rotation Speeds	**Frequency**	**Maximum peak-to-peak displacements in microns**	
rpm	Hertz	At Works*	At Site
3 000	50	24	30
1 500	25	41	52
1 000	16,67	55	69
750	12,50	65	81

* Please refer to Clause 1.3.3.5 “vibration tests”

(b) Severity ranges

- Peak-to-peak displacement amplitude

  The amplitude of peak-to-peak displacement vibration readings observed on a pump or other rotating machine shall not be higher than that which is allowed for its driving motor according to BS 4999: Part 50 for powers up to 150 kW.

(c) Tests to be performed

For pumpsets less than 22 kW, a hand held instrument test will be acceptable. For pumpsets between 22 and 150 kW, measures of the peak-to-peak displacement amplitude in the conditions detailed in subparagraph (b) are considered sufficient.

1.3.4.3 Tests to be performed at the end of the period of maintenance (see Clause 1.4.6.1)

The Contractor shall provide in his Tender for checking the condition of the impellers after one year service in the presence of the Engineer, in order to prove that the pumps are entirely cavitation-free. (This should coincide with the Final Inspection, in the case of a 12-month guarantee period.) The pumps shall be run continuously for at least 24 hours before the Final Inspection takes place.

The work to be performed shall consist of:

- checking the pump/motor alignment after disconnecting the coupling;
- visually inspecting of the impeller and casing (in the case of horizontally split casing pumps, removing the upper part will usually be enough for this inspection);
- inspecting all bearings;
- renewing gland packings;
- renewing all lubricants;
- checking that all valves are droptight under working pressure (see Clause 1.3.2.1 “tightness”); and
- recalibrating all flow, temperature and pressure monitoring equipment.

1.3.5 Acceptable Test Results

1.3.5.1 Performance tests results

Results of the performance, cavitation and vibration tests **at Works**

At the time of the performance tests at works:

- should the overall percentages of efficiency as calculated from the tests be less than the appropriate guaranteed figures at the duty points by more than 2%;

- and/or should the measured flow rates differ from the guarantee deliveries at any point other than the duty points on the characteristic curves as supplied by the Tenderer by more than 5%;

- and/or should the NPSH requirement not be met;

- and/or should the peak-to-peak vibration displacements be more than 10% higher than required,

the Contractor will be allowed a period of eight weeks to carry out any amendments to the plant which he may consider necessary to meet the guaranteed figures. Any period granted for design amendments shall not extend the Contract Period.

Further tests shall then be carried out at the Contractor's expense and if the test results in question are still not within the limits specified, the Engineer shall have the right to:

- either reject the entire plant and recover all monies already paid to the Contractor; and

- or, let the Contractor continue with the installation of the pumpsets which may be subjected to penalties or rejection as defined hereinafter when the performances tests at Site are performed.

Results of the performance, cavitation and vibration tests **at Site**

At the time of performance tests at Site,

- should the test results obtained for either efficiency, flow rate, NPSH or vibration still vary beyond the limits indicated in Clause 1.3.5.1 “results of the performance, cavitation and vibration tests at works” above; and

- the Contractor will again be allowed a further four weeks to make such amendments as may be considered necessary and if after these amendments have been made the test results in question are still not within the figures which have been guaranteed, the Engineer reserves the right, according to circumstances, to reject the plant entirely or to apply the penalties, as defined hereinafter.

Any other discrepancies, abnormal wear or malfunctioning of plant which may be observed during the Acceptance Tests shall be corrected by the Contractor without delay.

The date of completion shall be the date on which the Acceptance Tests at site have been satisfactorily completed and the plant is in a fully operational state in accordance with the Specification.

Any period granted for design amendments shall extend the Period of Maintenance by a corresponding amount.

Specified figures

Tenderers shall state in the Technical Schedule the guaranteed overall efficiencies and delivery rates when a single unit (i.e. pump with its driving motor) is operated against the specified total duty heads. These are called "duty points." Over and above these duty points characteristic curves shall be provided which cover the whole range of the flow (from 0% to 130% of the highest flow at duty point.)

1.3.5.2 Performance penalties

Penalties as a result of measured efficiencies lower than the guaranteed duty point efficiencies by more than 2% shall be calculated in accordance with the Project Specification.

Penalties shall be applied in the event of the pump flow rate at the rated duty point being less than that offered by the Tenderer. Monies to be deducted from the Contract Price shall be that percentage of the price of the installed pumpset and associated valves and pipework equal to the percentage reduction in flow rate at the pump rated duty point as specified in the Project Specification.

Any deduction shall apply to the Main Contractor only; the Engineer will not recognise any division of responsibility between the separate suppliers of pumps, motors and ancillary plant.

1.3.5.3 Rejections

The Engineer reserves the right to reject any pumpset, at the time of the Works test, the Acceptance Test on Site or after, during the Period of Maintenance in the following cases:

- Efficiencies at Duty Points defined, or average efficiency lower than the guaranteed efficiency(ies) by more than 5%.

- Discharge rate, at any Duty Points defined, lower than those guaranteed by more than 10%.

- Peak displacements and vibration velocities higher than specified (i.e. 4,6 mm/s for RMS velocity) by more than 20% at any point of measurement.

- Any sign of obvious cavitation.

- Total penalty on the pumpset higher than 15% of the unit price of the pumpset.

The Engineer reserves the right to reject any part of the equipment if the abovementioned corrections are not forthcoming.

Should any component part of any main or ancillary equipment fail to perform in accordance with its intended function during the Period of Maintenance, the Engineer shall have the right to reject the component part and order its replacement with a more reliable part at the Contractor's expense. The replacement part shall be guaranteed for a further twelve months or to the end of the Period of Maintenance, whichever is the later.

Rejection implies the recovery, by the Engineer, of all monies paid to the Contractor who shall remove at his own expense all the plant supplied by him when ordered to do so.

1.4 METHOD OF EXECUTION OF THE WORKS

1.4.1 General

1.4.1.1 Telephone

From the time of the award of Contract up to the end of the Period of Maintenance, it shall be expressly possible to contact the Contractor during all daylight hours including weekends and holidays and his number or numbers shall be made known to the Engineer for the purpose.

1.4.2 Tender/Contract Documents

1.4.2.1 Drawings – general requirements

Payments - costs

Late delivery of any documents and/or drawings shall entitle the Engineer to defer any associated payments.

The cost of all drawings required for the satisfactory execution of this Contract as specified shall be included in the Price Schedule.

Drawings sizes, etc.

Working drawings for the approval of the Engineer may be paper prints and shall be supplied in triplicate. Three copies of any revisions to the working drawings shall be supplied as the modifications are made and the date, number and nature of each revision shall be recorded in a table on the drawings. After approval and subsequent completion of erection of the plant, these drawings may be marked up and supplied as the final "as built" drawings. Final "as built" drawings shall be on unfolded, untearable transparent film, with a polyester base, having a matt finish on both sides and a base thickness of 0,05 mm.

The sizes of all drawings to be supplied shall comply with the A series of paper as specified in SANS 822 (3.6.1 A series). Standardized sizes A1 to A4 only shall be used.

The drawings shall be complete in all respects, drawn generally in accordance with SABS C.O.P. 0111 containing arrangements, assemblies, any necessary details and part lists including part numbers.

All drawings shall be dimensioned in the metric system of units and all titling and annotation shall be shown in the ruling language. Foreign language drawings will not be accepted.

Before completion of the Contract, the Contractor shall also supply any additional drawings that the Engineer may require.

Any drawings that do not conform to the above requirements will be returned to the Contractor for his attention. All drawings shall bear the Contract number and the name of the Pump Station.

Confidentiality

Should the makers consider any of the drawings or information to be confidential, the documents shall be marked "CONFIDENTIAL" and they will be treated as such by the Engineer.

Approval

Approval of a drawing or drawings by the Engineer shall imply approval of the proposed equipment in principle only and does not involve the Engineer in any responsibility with regard to the satisfactory functioning of the said equipment which shall be the sole responsibility of the Contractor.

1.4.2.2 Tender drawings and documentation

To be submitted by all Tenderers together with the tender documents:

- Outline and general arrangement drawings, graphs and pamphlets of the plant and/or electrical equipment giving sufficient information concerning the dimensions, characteristics, principle of operation, duties and function of the equipment to enable the Engineer to properly assess the offer from an economic, qualitative and civil works requirement point of view.

- For greater detail of drawings required for electric motors see Clause 2.2.4.4.

- For all standard pieces of equipment, full information (pamphlets) concerning the dimensions, characteristics, principle of operation, duties and function as supplied by the Manufacturer shall be included.

- As far as possible, type tests of all the equipment offered, issued by an internationally recognised laboratory - such as the SABS - shall be submitted.

1.4.2.3 Contract drawings and documentation

Further to drawings and documentation supplied with the Tender, the following working drawings and documents shall be submitted by the Contractor for the approval of the Engineer within 6 weeks of date of Order:

- Fully dimensioned outline and layout drawings of all plant and equipment to be supplied including ancillary equipment, giving full particulars as to the sizes and positions of all anchor bolts, bolt holes and other recesses; ducts, cable racks and conduits, trenches, vents and drains; oil, gland or cooling and service water and compressed air piping; cable routes and points of entry of all cables; anchor blocks, supports, foundations and embedded parts, including all necessary clearances around items of equipment and the lifting requirements and clearances for the crane, and any other information which may effect the construction of the Pump Station structure:

- The magnitude and direction of the thrust forces to be resisted by the foundations or anchor blocks shall be clearly given;

- Detailed dimensioned outline drawings of each electric motor, junction box and control console shall be included, showing the position of each panel, clearance space required and the height of each cable gland above the floor;

- Control logic diagrams;

- programme of execution of the works in full bar-chart form (see Clause 1.4.2.4);

- cash-flow forecast (see Clause 1.4.2.4); and

- contract documents (see below)

Note:

The above-mentioned information shall be binding once it has been approved by the Engineer. All costs due to alterations made after this approval will be invoiced to the Contractor. The Contractor will be required to formally approve the civil drawings made by others.

The following information shall be submitted to the Engineer before manufacturing commences:

- Except for standard pieces of equipment or instruments clearly defined beforehand, the Engineer's approval of shop drawings shall be obtained before commencing manufacture.

- These drawings shall replace typical drawings submitted with the tender documents and shall be submitted with the relevant computation notes and include:

  - updated general arrangement drawings,

  - detailed drawings of the pumps,

  - detailed drawings of the motors,

  - detailed drawings of the valves and their actuators,

  - all electrical drawings and circuit diagrams,

  - pump control console manufacturing details and instrumentation layout,

  - detailed drawings of all ancillary plant.

Complete material and cable schedules giving, for all components, inspection and test schedules, shall be submitted by the Contractor for approval by the Engineer within three months of date of Order.

At the completion of the Contract, final "As-built" certified drawings shall be supplied:

- Single prints of all final drawings shall be supplied to the Engineer in accordance with Clause 1.4.2.1 and shall include at least the following in A1 size drawings:

  - general arrangement of the pumping plant,

  - cross-section drawings of the main pumps,

  - schematic control wiring diagrams,

  General arrangement, both plan and section, showing the complete pumpline within the confines of the Pump Station to the same scale as the Departmental Pump Station layout drawings included with these tender documents.

- A3 or A4 prints of these final drawings shall also be bound into the Operating and Maintenance Manual as further specified under Clause 1.4.5.

- The final "As-built" drawings, together with the required copies of the Operating and Maintenance Manual, shall be supplied before the Certificate of Commissioning referred to in Clause 1.4.4.5 is issued. Any payments owing at this stage of the Contract will be withheld pending the receipt and approval of these documents by the Engineer (see also Clause 1.4.2.1).

- The issue of the Final Certificate, and therefore the final payment for the Contract will not be made until such time as that any outstanding final "As-built" drawings and/or copies of the Operating and Maintenance Manual as specified have been received and approved by the Engineer.

The Pump Station foundations and building work will be constructed by civil contractors to suit the accepted plant, according to the layout provided by the Contractor. The relevant civil works drawings will be prepared by the Engineer based upon the above-mentioned information as supplied by the Contractor. The Contractor will be called upon to signify approval of these drawings in so far as they affect his equipment before construction commences.

The Contract Documents to be provided in terms of this Clause shall comprise three fully completed additional bound copies of the Contract Document, comprising the fully updated accepted version of the tender offer including such further contractual documents as the Letter of Acceptance, the Order, Performance Bond, Form of Agreement and any other relevant documents.

1.4.2.4 Programme

The programme to be provided in terms of Clause 1.4.2.3 above shall be in full bar-chart form and sufficiently detailed to permit the follow up of fabrication and erection of the plant.

An updated programme shall be sent monthly to the Engineer, with indication of the achieved targets and of any revised dates.

The Engineer shall thus be kept informed on a monthly basis of the progress of the equipment in all Manufacturer's Works and, when the installation is started, of the progress at Site. Due notice shall be given of any inspection or test required as set out in Clause 1.3.

In addition to the abovementioned chart, a cash-flow forecast shall be submitted to assist the Engineer in managing the Contract. A monthly cash-flow update shall accompany the updated programme referred to in this Clause.

1.4.3 Assembly, Packing and Transport

1.4.3.1 Assembly in the workshop

Excluding any special deviation approved by the Engineer or his representative, each machine, appliance or assembly of the equipment shall be completely assembled in the Contractor's workshops. Each part shall be identified so as to ensure the correct assembly of the parts when they are erected on Site. All the adjustments and weldings, which may be made in the workshop shall be made so as to avoid as far as possible adjustments and weldings on Site.

1.4.3.2 Packing and dispatch

After the tests specified, the equipment shall be packed by the Contractor at his own expense, before dispatching.

The Contractor shall take all the necessary precautions to pack the equipment so as to prevent any damage.

For goods manufactured overseas, the packing shall be of the "packing for shipment" type.

Any equipment liable to marine corrosion, such as the electrical equipment, shall be placed inside the packing cases within watertight envelopes provided with desiccators.

The equipment sensitive to vibrations, such as the electrical cabinets shall be additionally placed in "vibration proof" packaging material.

In addition to the usual shipment marks, each package shall be clearly marked with at least the following

information to facilitate identification for final use on Site:

- Name and locality of the Scheme.
- Contract number.
- Component description.
- Mass (gross and nett)

The net and gross weights of the larger parts and the gross weight of the packing cases, shall be painted in easily legible figures on the packing materials before shipment from the manufacturer's workshops.

The transport of the equipment from the works of the Contractor or of his Subcontractors and the offloading on Site shall be carried out at the sole expense and under the responsibility of the Contractor.

The Contractor shall take all the necessary steps to store any equipment, which cannot be installed directly in its final position and shall ensure their protection and their maintenance throughout the storage Period.

1.4.4 Execution of the Contract at Site

1.4.4.1 General

The Contractor shall strictly comply with any security provisions which may be in force on Site at any time during the Contract Period. In particular the Contractor or his Subcontractors shall daily report their arrival and departure to the appointed Resident Engineer on Site or his Representative, and subsequently during the Period of Maintenance to the Regional Engineer or his Representative.

When called upon to do so during the period of erection and commissioning, the Contractor shall attend regular monthly co-ordinating meetings on Site between himself, other Contractors, the Resident Engineer and the Engineer.

1.4.4.2 Erection

The erection of plant shall be carried out by skilled and experienced erectors and the completed installation shall be of neat and workmanlike appearance, solidly supported, true to line and level, in proper working order and complying with this Specification and accepted engineering practice.

Erection shall include the maintaining of pipework in correct alignment during grouting. The Contractor shall grout in all pumpsets. Grouting shall be Embeco or equivalent non-shrinking grout.

Erection shall include the hydraulic testing of all pipework and welds fabricated at Site. Pipework to be tested on Site shall be filled 24 hours before pressurising.

The Contractor shall make good, at his expense, any damage caused by his staff or Subcontractors to civil works, paintwork or plant on Site. The Site shall be left clean and orderly.

1.4.4.3 Access for cabling

After the installation of each pumpset has been completed, the Contractor shall allow a period of approximately four weeks of uninterrupted access to enable other contractors to cable up the pumpsets and associated equipment and test the circuits.

1.4.4.4 Initial commissioning

On completion of mechanical and electrical erection and as soon as water is available and other circumstances permit, the Contractor shall arrange for the commissioning of one or more units of the pumping plant in the presence of the Engineer. The Contractor shall ensure that his equipment is suitably

prepared before giving the Engineer fourteen days notice in writing of the date of commissioning.

Before the Initial Commissioning, the Contractor shall satisfy himself and subsequently prove to the Engineer that all monitoring and operating equipment are functioning correctly.

Initial commissioning shall comprise the operation of all plant by the Contractor for such time as is necessary to put all components and equipment into proper adjustment and working order, as well as to calibrate any equipment requiring such attention and to coach operators in the proper operation of all plant. During this period the Contractor shall eliminate all causes of excessive noise or vibration and rectify any malfunction.

After the above commissioning, the plant shall be run under approved supervision for not less than two months before the Acceptance Tests are conducted. The Contractor must satisfy himself that the operators are in a position to operate the plant safely and correctly should he be absent from Site during this period.

Commissioning shall not be considered to be complete until the plant is capable of continuous operation by fully trained operators and until two months have elapsed and the plant has passed the Acceptance Tests as specified.

1.4.4.5 Acceptance tests – certificate of commissioning

The Acceptance Tests shall be performed only if and when every item of the whole Contract is fulfilled and if and when each piece of equipment, including the monitoring and control devices, is working properly. The Engineer is entitled to postpone the Acceptance Tests if any part of the Contract is not to his satisfaction or if the plant has not been successfully operated for at least 200 hours.

The Engineer may, at his discression agree to accept one complete pumpline at a time should the Contract consist of more than one pumpline.

The Certificate of Commissioning for the equipment is issued by the Engineer only when the results of the Acceptance Tests, recorded in a report prepared and submitted by the Contractor, are found satisfactory. A separate Certificate of Commissioning may be issued on request for a complete pump line only.

As-built drawings and final Operation and Maintenance Manuals shall be made available before the Certificate of Commissioning is issued.

The Period of Maintenance (or Guarantee Period) commences at the date of the Certificate of Commissioning.

1.4.4.6 Period of maintenance (or guarantee period) – final certificate

After the satisfactory conclusion of the Acceptance Tests on Site and the issue of the Certificate of Commissioning, the Contractor shall guarantee the satisfactory operation and functioning of the entire plant covered by the Certificate of Commissioning for a period of 12 months measured from the date of the Certificate of Commissioning.

The Contractor shall make good, free of all charges, any defects arising during this Period of Maintenance including the replacement of all defective parts and their installation and recommissioning. This guarantee shall apply to all defects arising during proper use of the plant, due to faulty design or maintenance instructions, inferior materials or poor workmanship.

Maintenance by the Client's personnel during the Period of Maintenance shall be limited to cleaning and lubrication only as instructed by the Contractor. All other maintenance or adjustments shall be carried out by the Contractor.

The Final Certificate will be issued by the Engineer when the Period of Maintenance has elapsed and all Contractual obligations have been met in accordance with the General Conditions of Contract.

1.4.4.7 Recalibration and servicing of instrumentation

It is the experience of this Department that instrumentation such as specified in this Tender, requires for its commissioning more attention spread over a longer period of time, than that required to commission the major items of equipment with which it is associated.

Not later than 4 weeks after the Acceptance Tests, the Contractor shall return to Site to recalibrate and service all the monitoring instruments and sensors (temperature and pressure measuring devices, vibration sensors, limit switches, water flow and level sensing devices), motor speed indicators, kilowatt and flow meters, indicators, recorders and the like.

He will repair any faults and assure himself that the instruments are in good working order.

During the Period of Maintenance, at least a further two visits, at approximately 4 to 6 monthly intervals, shall be undertaken, the last one to coincide with the Final Inspection for the purpose of issuing the Final Certificate.

During these recalibration visits the Contractor shall instruct the Client's maintenance staff to ensure the correct maintenance procedures. A report of these visits shall be issued in the form of a normal Test Report.

The cost of recalibration and servicing of the instruments shall be included in the total Contract Price.

1.4.5 Operating and Maintenance Manual

1.4.5.1 Draft copy and preliminary operating instructions

The Contractor shall provide fully illustrated Operating and Maintenance Manuals for the complete plant in his supply. The draft copy shall be submitted to the Engineer for approval before the beginning of erection.

Preliminary Operating Instructions (which may be extracted from the draft manual), shall be available at the time of Initial Commissioning and handed to the Client's Operations Staff in the presence of the Engineer (see Clause 1.3.4.1 "Preliminary Operating and Maintenance Instructions").

Failure to provide either of the abovementioned documents in due time is a sufficient reason for the Engineer to postpone payments and/or the date of Initial Commissioning.

1.4.5.2 Abridged operators instructions

Five copies of an abridged version of the operating instructions shall be provided together with the 5 final copies of the Operating and Maintenance Manual referred to in Clause 1.4.5.3. The purpose of these Abridged Operating Instructions will be to facilitate training of the shift operators in their day-to-day duties.

These Instructions shall comprise on abridged version of the basic plant operating procedures written in plain English and accompanied by basic diagrams, if necessary, to the Engineers satisfaction.

The format shall be A4, with all typing double spaced capitals. Pages shall be typed on one side only and the whole shall comprise not much more than 5 or 6 pages.

The binding shall be a hard backed plastic covered file containing a suitable number of plastic pockets, permanently clamped into the binding, and into which the typed pages shall be inserted.

1.4.5.3 Final Manual

Binding

The manual(s) shall be bound in A4 size hard backed 4-ring binders with clear pockets on the spine and front cover for insertion of title slips.

Drawings, the originals of which are larger than A3 size, shall be reduced to A3 and included in the binder.

Format

The format and final content of the Operation and Maintenance Manual shall be discussed with and approved by the Engineer.

Copies

Five copies of the approved Operating and Maintenance Manuals shall be supplied by the Contractor within four weeks of the draft copy being approved, which should take place immediately after the Initial Commissioning of the plant.

Contents

The manual shall cover the following aspects in detail, with illustrations and drawings:

- Index: Each volumes shall have an index following the title page. If there is more than one volume, the first volume shall contain a master index;

- General Description: this is aimed at Artisans and Operating personnel and should be couched in simple terms with little technical detail;

- Pre-commissioning checks: These shall be clear, concise, easy to follow and shall include pre-start checks (e.g. check oil and water, remove locking pin, etc.), safety checks (e.g. personnel cleared from vicinity of water outlets, guards in place, etc.);

- Detailed operating instructions: These shall be clear concise, easy to follow and shall include starting procedure, running checks (e.g. no vibration, pressures normal), shut-down procedure, emergency shut-down procedure and action to be taken in response to alarm signals;

- Proposed preventative maintenance schedules and programme covering all plant and equipment; the Maintenance chart:

  - If a manufacturer's manual is included to cover a 'bought-in' item then the relevant maintenance instructions must be extracted and included on a master chart so that the operator has only one checklist of periodic servicing to cover the whole installation.

  - A separate lubrication chart shall be drawn up on similar lines to accompany the Maintenance chart;

- Fault diagnosis and repair procedures: These shall include details of all servicing, replacement and repairs which Artisans or Operating personnel would be expected to carry out on Site. In this section the reader may be referred to suppliers brochures elsewhere in the Manual for specific detail;

- Schedule of manufacturing drawings;

- Detailed schedule of plant components giving material specifications, part numbers, etc. Where possible, drawings shall be positioned opposite the appropriate text;

- Sub-contractor's/Supplier's brochures and instructional literature:

  - only original literature shall be incorporated in the manual - copies will not be acceptable.

  - where a range of products is covered in the one brochure, relevant details applicable to this Contract shall be clearly marked and any others cancelled. If one or two pages only of a brochure apply, then the remainder, containing superfluous information, shall not be included in the Manual;

- Commissioning and other test results (see Clause 1.3.3);

- Schematic diagrams of the control systems;

- Complete wiring diagrams;

- Cable schedules;

- Schedule of maintenance tools provided and the use of special tools;

- Detailed philosophy of the control equipment including diagrams and description of the duties of the various relays and/or PLC's;

- Detailed fault finding procedures for the control equipment.

Non availability

Acceptance Tests will not be performed and payments may be deferred if complete and final Operating and Maintenance Manuals are not available.

1.4.6 Final Inspection at Site

1.4.6.1 Final inspection

The Final Inspection shall take place on Site just prior to the termination of the Period of Maintenance, and shall be arranged by the Contractor. At least two weeks notice in writing shall be given to the Engineer.

The purpose of this inspection visit shall be to satisfy the Engineer that all Contractual obligations have been satisfactorily met prior to the issuing of the Final Certificate and the Pump Station being finally handed over to the Department. Representatives from all major Subcontractors, as well as the Contractor himself, shall attend.

Tests described in Clause 1.3.4.3 shall be carried out to the full satisfaction of the Engineer before the Final Certificate will be issued.

PM 2 : SPECIFICATION FOR MECHANICAL EQUIPMENT

2.1 MAIN PUMPS

2.1.1 Type and Arrangement of Pumps

Taking into consideration specific speed calculations, efficiencies and reliability of the pumpsets the proposed pump types shall be justified in the Tender.

Arrangements incorporating multiple pump units coupled in series to achieve the duties specified in the particular specifications will not be favourably considered unless otherwise specified.

The arrangement of impellers shall be such as to reduce the residual axial thrust to a minimum. Designs incorporating a double suction will be preferred.

A design and arrangement of the pump casing which ensures that it is not necessary to disconnect the delivery pipework for the purpose of removing or replacing the complete rotating element will receive favourable consideration.

Suction and delivery details: The orientation of the suction and delivery pipes shall be such as to facilitate maintenance whilst being designed for minimum losses and no air traps.

The proposed arrangement of the pumpsets and associated pipework is shown on the drawings enclosed with this enquiry.

2.1.2 Pump Characteristics

The pumps shall have stable, non-overloading characteristics.

The Tenderer shall submit with this Tender for each pump offered the following characteristic curves:

With respect to flow:

- total head;
- power demand;
- efficiency;
- net positive suction head (NPSH) requirements, critical and 3% "head loss", relative to pump shaft centre line, in the case of horizontal spindle pumps;

With respect to speed:

- torque requirements rated in absolute units.

Alternatively, NPSH requirements related to 3% drop in head may be given, if preferred, as long as the method of presentation is clearly stated.

These characteristic curves are to be submitted with water flows stated in litres per second covering the full possible pump operating range.

Pump shaft rotational speed shall not exceed 1 500 r.p.m.

Specific intake velocity, S, (defined hereunder) shall under no circumstances exceed the value of 160 per impeller inlet, unless detailed and acceptable justification is given.

$$S = \frac{n \times Q}{N_{sh}^{3/4}}$$

Q = capacity in m^3/s (if double entry impeller, equals half pump capacity)

Nsh = absolute suction head in metres (Nsh = Ha - Hs - Po)

Ha = atmospheric pressure at the elevation of the pump in metres of water

n = rotational speed in revolutions per minute

Hs = difference in level of the highest point of the impeller entry above the water level on suction side, increased by the head losses in the suction line in metres of water.

Po = vapour pressure in metres of water.

The Contractor may be called upon to provide further curves at the request of the Engineer, especially for starting and stopping analysis, in connection with surge analysis in the rising mains.

The efficiency curve shall be flat over a wide range in order to provide efficient working with various pump operating conditions. It shall conform to the requirements of the Project Specification.

2.1.3 Pumping Rates

Unless specified to the contrary, the proposed pumps shall be able to operate without perceptible signs of cavitation in the full range of heads specified, pumpsets running singly or in parallel. Throttling shall be allowed only under exceptional operating conditions.

2.1.4 Impellers

All impellers shall be cast in stainless steel as given in the Project Specification.

The castings shall be free of blow-holes and other defects. No welding, burning, filling or plugging of defective castings shall be permitted without prior approval being obtained from the Engineer in writing, following an inspection of the defects.

Impeller shrouds and blades shall be of adequate thickness after they have been dressed, the minimum thickness being equal to : 7,00 (mm) for impeller diameters less than 350 mm and 0,00625 x diameter of impeller (mm) + 5 mm for impeller diameters equal to or greater than 350 mm.

All water passages are to be finished smooth to a template or NC machine finished.

All impellers shall be fitted with replaceable wearing rings of gunmetal or bronze. These rings, which shall be "L" cross-section, shall be secured to the impeller with non-corroding screws and mechanically locked.

Each impeller shall, after final machining and dressing, be independently statically balanced and the completely assembled rotating element with coupling shall be dynamically balanced.

The critical speed of the rotating element shall be considerably higher than the running speed.

2.1.5 Pump Shaft, Sleeves and Diffusers

Pump shafts shall be of an approved material, to En26 or equivalent and of sufficient dimensions to transmit the power to which they will be subjected without undue torsional or bending stresses and deflection.

The shafts shall be stress-relieved after initial machining, and ground to final size.

The shafts shall be suitably designed for the reception of the impeller, which shall be adequately secured

to the shaft in such a manner as to be readily removable without damage to either the shaft or the impeller.

The Contractor shall ensure that both the critical speed and torsional oscillation characteristics of the combined pump and motor rotating elements are satisfactory for all possible conditions of operation.

The shafts shall be adequately protected with replaceable sleeves of an approved bronze or other similar approved non-corrodible material at all areas where wear and/or corrosion could possibly be expected. These sleeves shall be readily removable without causing damage to either the shaft or the sleeves.

If separate diffusers are used, they shall be cast in an approved zinc-free bronze or stainless steel and finished smooth all over.

2.1.6 Pump Casing

The pump casings shall be manufactured in normal SG Iron to grade GGG or stronger non-corrodible approved material as may be specified in the Project Specification.

The casings shall be double flanged with flanges in all respects as required for the valves (see Clause 2.3.5) and bolt holes drilled off-centre; also stiffened with ribs as required at all points of high stress.

No welding, burning, filling or plugging of defective castings shall be permitted without the Engineer's permission in writing, following an inspection of the defects.

The inspection and testing of castings and test bars shall be in accordance with BS 3100.

The dimensions and drillings of the suction and discharge flanges integral with the pump casings shall be to SABS 1123 (according to design pressures specified).

The pressure rating of the delivery flanges shall be at least equal to the maximum suction static pressure, plus the pump shut-off pressure. The minimum pressure rating of the flanges shall be 1 MPa (10 bar).

All pump casings shall be hydrostatically tested at the Manufacturer's workshop and in the presence of the Engineer or his Representative.

Particular care must be exercised in designing a pump casing which will resist the tendency to crack through the cutwater or guide passage walls during the pressure tests and the Tenderer is to indicate clearly in his tender the design features incorporated in his pump to ensure that this requirement is satisfied.

2.1.7 Pump Bearings and Lubrication

2.1.7.1 Bearings and Lubrication

The bearings in the pump casing together with its lubricating systems shall be suitable for the particular circumstances. The particular type and system offered by the Tenderer shall be fully specified.

2.1.7.2 Safety Instrumentation

The main bearings shall be provided with the necessary safety instrumentation incorporating the necessary alarm and trip facilities for temperature and vibration (see Clause 2.6.2).

2.1.7.3 Type of bearing

The pump rotating element shall be positively located in the axial direction by means of a thrust bearing:

- in the case of horizontal spindles bearings may be either journal or rolling bearings;
- vertical spindle pumps shall be provided with:

- cutless rubber line-shaft bearings enclosed in a tube and provided with separate filtered "through-flow" lubrication water;
- conventional journal or rolling type thrust, top and bottom bearings;

- all bearings shall be suitable for shaft rotation in both directions;
- preferably the same type of bearing will be chosen for motor and pump;

if not, the necessary allowance shall be made when aligning pump and motor.

2.1.7.4 Cooling of lubricating oil (if applicable)

Adequate provision shall be made for the cooling of oil for bearings, particularly as the pumps may run continuously in ambient temperatures of the order of 40°C. The bearing metal temperatures shall not exceed 60°C during continuous operation. The cooling of the oil may be natural or by forced air circulation or by water circulation through coolers mounted either in the bearing pedestals or separate water coolers with forced oil circulation.

The oil cooler shall be easy to clean out. Full details of the oil cooler design shall be included in the Tender offer.

2.1.7.5 Lubrication

- All internal surfaces in continuous contact with the lubricating oil such as oil reservoirs, piping, etc, shall be thoroughly cleaned either chemically or by shot blasting and protected by a method to be approved by the Engineer until such time as the system is charged with oil. No site welding of oil circulating pipes will be permitted.
- Circulation oil lubrication systems incorporating pumps, when required, shall include:
  - two 100% duty motor driven oil pumps;
  - two 100% rated full-flow oil filters;
  - duplicate pressure relief valves;
  - oil pressure relays;
  - enclosed oil reservoir with level indicator and oil filter and drier breather;
  - all necessary piping, valves, gauges, relay switches, alarms etc.
- The entire lubricating system shall be fail safe with alarms set to indicate automatic change-over to the stand-by unit.
- Selection of duty pump shall be made by a manual selection switch.

2.1.8 Glands and Seals

2.1.8.1 Reliability

Reliability of glands is of prime importance. Pumps incorporating low pressure glands where the pressure at the glands does not exceed the main suction supply pressure will be preferred to pumps with shaft glands exposed to higher pressures.

2.1.8.2 Glands

Low pressure glands of the conventional stuffing box pattern utilising packing rings on each side of lantern rings will be acceptable for the first stage of the pumps. Lantern rings shall be easily removable. The shaft sleeves shall be ground with a polished finish on the wearing surface, and the gap between the sleeve and the follower shall be such that the packing will not be extruded into the gap. Make and type of packing shall be to the approval of the Engineer.

2.1.8.3 Water to the glands

It will be the responsibility of the Contractor to provide filters if the quality of the water necessitates filtration. The flow of water to or from the glands shall be clearly visible.

2.1.8.4 Mechanical seals

If mechanical seals are offered, they shall be balanced and proved to be suitable for the water pumped. Spare wearing components shall be supplied and delivered when the pump is installed, the cost being included in the price of the pump.

2.1.8.5 Supply details

The Tenderer shall supply with his Tender, full details of all pump seals and glands incorporated showing clearly all proposed materials, finished clearances, etc.

2.1.9 Pump Vent and Drain Fittings

Bronze vent cocks shall be provided and fitted at all local high points on each pump casing. These cocks shall be of adequate size to enable the entrapped air to be released freely. Copper drain pipes shall be neatly led from priming cocks, gland and casing drain points to a suitable main tundish. Galvanised drainage pipework of adequate size shall be provided and installed to collect the wastewater from each pumpset and to lead it to the drain leading to the pumphouse sump.

2.1.10 Designation and Information Plates

Information plates: each pump shall be provided with a substantial information plate, preferably chromed or stainless steel, securely fastened to the pump casing in a readily visible position, and clearly and indelibly marked with the following details:

- maker's name, pump type, serial number and order number,
- contract number,
- year of manufacture,
- rated duty of pump in litres per second,
- head in metres at rated duty,
- pump speed in rpm,
- mass of upper casing in kg, (for horizontal split casing pumps,)
- mass of lower casing in kg, (for horizontal split casing pumps,)
- mass of complete rotating element in kg,
- mass of completely assembled pump in kg.

Letters and figures shall be engraved, or embossed, not stamped.

Number plate: in addition, each pumping unit shall be provided with a chromium plated or stainless steel number designation plate not less than 100 mm square indicating "No 1", "No 2", etc., mounted in a position readily visible from the control console area. Number order shall be to the satisfaction of the Engineer.

2.1.11 References

The Tenderer shall present in Annexure "B" references of pumps of the same type and size as the pumps offered which have been running under similar conditions for at least 5 years.

2.2 MOTORS

2.2.1 General Requirements

Electric motors supplied shall be designed, manufactured, tested, delivered, erected and commissioned in accordance with this specification and with the current edition of whichever of the following standard specifications applies:

SABS 948	-	Three phase induction motors (up to 150 kW per 1 000 rpm)
BS 587	-	Motor starters and controllers
BS 3763/555	-	Metric dimensions for electric motors
BS 4999	-	General requirements for rotating electrical machines
BS 5000	-	Rotating electrical machines of particular types
IEC 85	-	Recommendation for the classification of materials for the insulation of electrical machinery and apparatus in relation to their thermal stability in service

Motors complying with the German DIN and Japanese standards will also be considered.

2.2.2 Design

Because motor failure can result in outages of major pumping plant, design features aimed at marginally improving motor efficiency at the possible expense of reliability will not be accepted. Particular attention shall be paid to such items as the integrity of the insulation system, bracing of stator end windings, adequate dimensioning and cooling of bearings, and method of connecting short circuiting rings to rotor bars in cage rotors.

2.2.2.1 General design

- Unless otherwise approved, a.c. motors shall have squirrel-cage rotors and be suitable for direct on-line starting and operation on a three phase supply.

- Insulating materials used in the motor windings shall be rated Class F or higher as permitted by SABS 948 and BS 4999 for motors rated at 3 300 volts or higher. Motor temperatures shall not be permitted to rise higher than the limits specified for Class B materials, thereby assuring an operating safety margin.

- Individual stator conductor turn-to-turn insulation shall be not less than varnish coating on the wire over which mica or glass tape shall be wound.

- Both rotor and stator laminations shall be treated after assembly with a solvent-free thermosetting resin;

  - the rotor by no less than full emersion dipping;

  - the stator laminations and windings by a vacuum-pressure impregnation process (VPI) to enhance insulation and prevent corrosion and vibration of the independent lamination pieces.

- End-coil overhang shall be adequately supported with fibreglass cord or equal to prevent movement.

- The stator windings of the main pumps motors shall be star connected. In motors rated at 2 000 kW or higher, each end of each phase winding shall be brought out to a separate terminal box. For motors rated less than 2 000 kW, a separate terminal box will not be necessary. Any permanent interconnection between different phase windings is not acceptable.

- Motors having attained full load temperature, shall be capable of making three starts within the hour, two of which may occur at a minimum interval of five minutes.

- Motors having sleeve bearings shall be designed to permit air gap measurements to be taken at four equally spaced positions at each end without having to remove the end shields from the motors.

- For motors larger than 500 kW, the complete rotating assembly of the motor (including the motor half coupling) shall be dynamically balanced.

2.2.2.2 Starting requirements

- Unless otherwise specified in the Project Specification or approved by the Engineer, the starting current for squirrel-cage motors shall be limited to 6 times the normal full load current for motors below 150 kW, 5 times full load current for motors up to 1 000 kW and 3,5 times full load current for motors above 1 000 kW. DC motors shall be designed to permit contactor starting in accordance with the peak currents given in Table 6 of BS 587. Particular attention shall be paid to the design of two-pole motors, if acceptable, to ensure that they comply with modern practice in regard to noise and vibration levels.

- The motor starting torque shall be at least 10% in excess of the maximum torque required during the starting period up to 100% speed.

2.2.2.3 Heater elements and temperature detectors (see also Clause 2.6.2)

- Motors rated at 350 kW or larger shall be provided with 220 volt, single phase heater elements situated adjacent to the end-windings to be maintained at a temperature above the ambient when the motor is out of service.

- Unless stated otherwise in the Project Specification, Motors larger than 350 kW shall be provided with embedded temperature sensors situated in the stator slots, adjacent to a coil, two for each of the phases.

- The sensors shall be compatible with the monitoring equipment.

- Motors less than 350 kW shall be provided with at least two temperature detectors located within the motor to register the highest expected winding temperature.

- For temperature sensors in motor bearings, see Clause 2.2.2.8.

2.2.2.4 Rotation direction

- A.C. motors fitted with uni-directional fans, and therefore not capable of being easily reversed, shall be supplied to suit the direction of rotation of the driven machine. The correct direction of rotation of any uni-directional motor shall be indicated in a permanent manner on the frame.

- The main pump motors shall be capable of being driven indefinitely at full speed in reverse direction.

2.2.2.5 Terminals

- Terminals on all motors shall be permanently marked A, B, C or U, V, W, reading from left to right when facing the terminal box. On single ended shaft motors, irrespective of the rotation required on Site, the connections shall be such that when the R,W,B, supply leads of a phase rotation system rising in that order, are connected to the motor terminals A,B,C or U,V,W, respectively, the motor shall rotate in a clockwise direction when looking on the driving end.

- On uni-directional motors the connections shall be such that when the R, W, B, supply leads are connected to motor terminals A, B, C or U, V, W, the motor shall rotate in the correct direction to suit the motor frame.

- A suitably effective method of relieving the stress on terminal studs caused by the pull of the power cable shall be provided.

- Vulcanised rubber insulation shall not be used for the connection from windings to the terminals.

- All motors shall be provided with an earth terminal at a convenient position on the motor frame near the incoming termal box.

2.2.2.6 Terminal boxes and cable entry boxes

- All terminal boxes shall be complete with nuts, lock nuts, cable lugs and crimping ferrules as required.

- The degree of protection shall not be less than IP 55.

- Cable entry boxes shall be complete with cable clamps and undrilled gland plate. Glands will be supplied and fitted by the cabling Contractor.

- Terminals on low voltage motors shall be enclosed in a box sealed with gaskets and equipped with removable gland plates to suit the gland for the cable entry being used. The degree of protection shall be not less than IP 54. The cable outlet shall be capable of pointing to any one of four positions at 90^{o} intervals.

- Terminal boxes on motors rated above 150 kW and/or 3 300 volts shall comprise a box sealed with gaskets and provided with a separate cable entry box suitable for terminating up to a 70 mm 2 plastic insulated cable. Provision shall be made to permit the motor to be removed without disturbing the cable termination.

- Terminal boxes on motors rated higher than 1 000 kW or 3 300 volts shall be of the totally enclosed phase separated type and sealed so as to exclude the entry of moisture and dust from both the internal air circuit of the motor and from the outside. The terminal boxes and covers shall be fabricated from mild steel plates and all joints shall be flanged with gaskets of neoprene or other approved material. Natural rubber shall not be used as an insulator for terminals, leads or gasket material. A pressure relief diaphragm of approved design shall be provided to protect the terminal box from disintegration in the event of an electrical fault occurring in the box. A desiccator shall be fitted and shall have an indicator head, which shall be visible without opening the box.

- When motors are provided with heaters or embedded temperature sensors they shall be wired up each to separate secondary terminal boxes having removable undrilled gland plates.

- Cable entry boxes fitted to motors rated above 3 300 Volts shall be suitable for PEX type cables (cross-linked polyethylene) and shall be provided with adequate front access to cable clamps installed to prevent strain from cable being transmitted to the terminals.

- Terminal boxes shall be large enough to accommodate surge suppression equipment (ZORC or equal) for motors rated above 380 Volts. Adequate separate access shall be provided to this equipment.

- Rated voltage shall be indicated on terminal box covers.

- The design of all terminal boxes shall be submitted for the approval of the Engineer prior to manufacture.

2.2.2.7 Cooling of lubricating oil (if applicable)

See Clause 2.1.7.4.

2.2.2.8 Bearings

- Sleeve type bearings will be preferred to rolling type bearings when:

. rotation speed is 1 500 rpm or less and installed power is greater than 500 kW.

. rotation speed is greater than 1 500 rpm and installed power is greater than 200 kW.

- For the purpose of maintenance, end-shield mounted bearings are preferred.

- Care shall be taken that bearings are sealed properly in order to prevent ingress of bearing lubricant into windings and cores.

- Adequate provision shall be made to prevent damage to bearings by any shaft currents, which may be produced.

- When the motor shaft is not located axially by its own bearings it shall be permanently marked to indicate its normal running position and the extent of float in either direction.

- Unless otherwise approved in writing, motor bearings shall be designed so as to allow the motor to run indefinitely at full speed in either direction.

- If rolling bearings are used, they shall be loaded conservatively in order that the grease may be renewed at intervals of not less than one year.

- If sleeve bearings are used they shall be of the plain journal type and not of the segmental type and they shall be automatically lubricated by at least two oil rings or a single disc integrally mounted on the shaft, running in an oil bath of adequate capacity or by forced lubrication. The oil bath shall be fitted with a drain plug and external oil level indicating device which is readily accessible and visible.

- Should forced lubrication be used, the oil pump unit shall be totally separate from the pump. The temperature of the oil as it leaves the bearings shall not exceed 60^{o}C. A suitable pressure switch shall be provided to start and stop the oil pump motor. The control for the oil pump motor shall be provided by the Contractor (see also Clause 2.1.7.4).

- Should a motor be fitted with sleeve bearings, the bearings shall be equipped with thermometer pockets for receiving mercury glass thermometers. Where bearing temperature detectors are called for, they shall be of either the thermocouple or resistance temperature detector (rtd) type. If called for, temperature indicating instruments shall be graduated in ^{o}C and shall be equipped with a pair of adjustable contacts arranged to close on rising temperature. The contacts shall be rated to suit the requirements of the control circuit (see also Clause 2.6.2.2).

- Vertical motors shall have bearings generally complying with the above requirements but when sleeve bearings are provided, the thrust bearing shall be of the Michell type and shall have a separate temperature detector.

2.2.2.9 Couplings

- Each pump shall be directly coupled to its electric drive motor. Adequate bearing provision shall be made in the pump to resist axial thrust.

- Coupling guards shall be provided in accordance with the Machinery and Occupational Safety Act and to the approval of the Engineer.

2.2.2.10 Baseplates

- The pump and motor baseplates shall be rigid, either one piece or separate embedded in one single concrete plinth, and, if of fabricated construction, shall be stress-relieved. The upper face(s) of each baseplate upon which the pump and motor are located shall be machined flat and smooth. Substantial lugs fitted with horizontal jacking screws shall be an integral part of each main pump and motor baseplate to facilitate alignment of the motor and pump.

- The pump and motor of each set shall be properly aligned and shimmed and then grouted with a completely stable grout (Embecon or equal) to facilitate vibration free operation.

2.2.2.11 Enclosures and cooling

- All motors shall have at least IP 22 or IP 55 type enclosures as specified in the Project Specification.

- Motor cooling shall comply with one of the following types:

  - Self-ventilating open; (IC 01)
  - Totally enclosed fan cooled; (IC 01 41)
  - Totally enclosed motor with internal fan and external air fan-fed through cooling tubes; (IC 01 51)
  - Totally enclosed motor with internal fan and external air duct-exhausted from cooling tubes; (IC 27 61)
  - Totally enclosed motor with internal fan and circulating cooling water fed through cooling tubes; (IC W37 A81)

  as detailed in BS 4999 and more fully specified in the Project Specification.

- All motors installed outdoors shall be weatherproof in accordance with BS 4999.

- Main pump motors shall be either (1C 01 41), (1C 01 51), (1C 27 61) or (1C W37 A81) as more fully described in the Project Specification.

- Where cooling air is ducted out of the building, it shall be possible to divert hot air back into the Pump Station for the purpose of improving the air conditioning during the cold season.

- All air ducts and/or water piping and fittings between the main pump motors and the cooling water circulating pumps or the outside of the building shall be included in this Contract,

- Technical details concerning cooling systems shall be given in the Technical Schedule of Motor Particulars to enable the alternative offers to be compared.

2.2.3 Ratings

2.2.3.1 Power rating

- The kilowatt and starting torque rating of motors shall be sufficient to provide at least a 10% margin above the torque requirements of the pump throughout the entire speed range calculated in absolute terms with the supply voltage reduced to 80% rated voltage.

- All motors shall be capable of continuous operation over the range of ambient temperatures from -10^{o}C to 40^{o}C at the altitude of the Pump Station.

- The electric motors for the valve actuators shall be at least "10 minutes" rated, or rated for such longer period required by the valve movement.

- In all running conditions the power rating of the motors shall be higher than the maximum possible power requirement of the pump by not less than 10%.

2.2.3.2 Voltage rating

- All motors shall be suitable for operation at any voltage within the range plus and minus 7 (seven) percent of the nominal rated voltage. Motors rated for continuous use shall be capable of operating at rated load and 75% of nominal voltage for a period of 5 minutes without injurious heating.

- The following power supply systems are considered standard (but not necessarily available at all sites):

  (a) Single phase, 50 Hz, 220 Volt supply

  (b) Three phase, 50 Hz, with earthed neutral:

    - 380 volt
    - 3 300 volt
    - 6 600 volt
    - 11 000 volt

The arrangement will usually be as follows:

Size of motor	Voltage rating	Cable and terminal boxes - refer to Clause 2.2.2.6 above
Low voltage A.C. motors	400/380/230 V	VPVC with box to suit
A.C. motors from 150 kW to 1 000 kW	3,3 kV	70 mm² and cable with box to suit
A.C. motors larger than 1 000 kW	3,3 or 6,6 kV	(Totally enclosed, separated type to the Engineer's approval.)
A.C. motors larger than 1 800 kW	6,6 kV or 11,0 kV	

2.2.4 Miscellaneous

2.2.4.1 Material

- All material shall be new and of the best quality and of the class most suitable for the purpose specified. All parts shall be fabricated of such material as shall ensure their being capable of withstanding variations of temperature arising under working conditions without distortion or deterioration or setting up of undue strain in any part of the work which they have to perform. Unless otherwise specified or approved, all material shall comply with the most recent South African, German, Japanese or British standards applicable. Should conflict occur between the South African and any of the above standards, the former shall apply.

- Cast iron shall be to BS 1452 Grade 220, or better and shall be tested in accordance therewith.

- Mild steel plate for fabricated parts shall be of weldable quality in accordance with BS 4360.

- No welding, burning in, filling, plugging up or metal deposition to correct defects in any component will

be permitted unless agreed to by the Engineer in writing, following an inspection of the defect.

2.2.4.2 Interchangeability of parts

All similar parts are to be made accurately to dimensions and must be interchangeable with each other, so that a spare part or any part of another similar motor can be used satisfactorily in the relevant position on a motor without recourse to additional machining or filing.

2.2.4.3 Information plates:

Each motor shall be provided with a substantial information plate, preferably chromed or stainless steel, securely fastened to the motor casing in a readily visible position, and clearly and indelibly marked with at least all the details required by BS 4999. Letters and figures shall be engraved, not stamped. The plate shall be comparable with that required for the pumps, see Clause 2.1.10.

2.2.4.4 Drawings: The following drawings shall be submitted (see also Clause 1.4.2.2)

- Dimensioned outline and foundation drawings of the motors (shaft diameter, protruding shaft length, shaft height and motor weight to be clearly shown);
- detailed drawings of the bearing arrangement, showing all oil pipes, coolers and pumps;
- cross-sectional dimensioned drawings of the terminal and cable enter boxes;
- detailed drawings of the motor baseplate showing full constructional details with dimensions;
- for motors of 250 kW and larger, fully dimensioned drawings of the shaft showing all tolerances;
- for motors designed for voltages of 3,3 kV and above, drawings showing the end winding bracing arrangements.

2.2.5 Inspection

The Engineer or his appointed Representative reserves the right to inspect the motors or associated parts at any stage of manufacture.

The Contractor shall ascertain whether inspection is required and the Contractor shall then give the Engineer not less than two weeks notice of when the inspection may be undertaken, or 21 days in the case of overseas inspection.

In the case of a test being undertaken at a Manufacturer's Works overseas, the Contractor shall propose an acceptable inspection authority to witness the tests on behalf of the Engineer.

2.2.6 Details to be Specified with Motor Orders

The following is a summary of the information that should be given to the motor Manufacturer when orders for motors are placed.

General: Site, altitude above sea level, ambient temperature range, place to which motors are to be delivered, required date of delivery of motors, site system voltages.

Particulars as applicable: Designation of driven machine, total number of motors called for, class of duty, class of winding and temperature rise (F class winding with B class temperature rise), motor specification, starting current limitation, starting torque requirement, speed or speed range, number of motors for each particular duty, horizontal or vertical motor, type of terminal and cable entry boxes to suit the type of cables specified, type of coupling, state whether motors are to be situated outdoors; state whether motor bearings have to absorb thrust from drive, inertia of driven machine; state whether motor bedplates to be provided by the motor Manufacturer; state whether motor half-couplings are to be fitted; state special air or other

cooling outlets required; state required direction of rotation and precautions for reverse rotation (of the pumpset); specify designation plate; specify temperature detectors and heater elements required.

Include all specific requirements highlighted in the Project Specification.

2.3 VALVES

2.3.1 General

This Specification covers the main valves, as well as the auxiliary water or air valves.

If an unproven design is proposed, the Engineer reserves the right not to accept the proposed design until the prototype has been satisfactorily tested.

2.3.2 Valve Requirements

Unless otherwise specified in the Project Specification, each pumpset shall be provided on the delivery side with an autoclosing control valve.

- When starting a pumpset, the control valve shall be closed and the isolating valves fully opened.
- The opening of the control valve shall be slow in order to avoid pressure surges in the rising main.
- As far as possible, before stopping a pumpset, the control valve shall be closed slowly.
- If this is impossible (in the case of power failure or of serious fault on the pumpset or other "trip" condition) the quick autoclosing function of the control valve shall close the valve within an adjustable period of a few seconds.

In order to allow maintenance without disturbing the operation of the Pump Station, the pumpsets and, if applicable, their associated control valves shall be provided with appropriate isolating valves. Normally, butterfly valves will be provided at the inlet side and sluice or butterfly valves at the delivery side as more fully detailed in the Project Specification.

All inlet and delivery isolating valves and control valve, on their actuators shall be equipped with limit switches.

2.3.3 Design Pressure

The design pressure of the valves shall not be less than the pressure specified, subject to a minimum of 1 MPa (Table 10).

The valves and the pipework shall be tested hydrostatically to a pressure of not less than 1.5 times the design pressure. The valves shall be drop tight at the design pressure (see also Clause 1.3.3.2).

The design pressure shall be not less than either the maximum working pressure or 75% of the maximum anticipated surge pressure.

2.3.4 Head Losses

The Tenderer shall give as a function of the downstream pressure the maximum acceptable discharge of water through the valves of the main circuits without risk of vibration and cavitation. He shall also give the head-loss characteristics of the main valves.

2.3.5 Flanges

All valves shall be double-flanged with bolt holes drilled in accordance with SABS 1123.

Sealing faces shall be machined flat to a toolmark of 0,8 mm to 1,25 mm pitch spiral or concentric serrations and backs of flanges to be either machined or spot-faced around holes with sufficient clearance to ensure proper seating of bolt heads and nuts. The Contractor shall check the compatibility of drilling of all flanges to be connected together.

Flange thicknesses and bolt sizes shall conform to the appropriate table of SABS 1123.

The Contractor shall satisfy himself that the flanges in his supply shall match the flanges supplied by others, if any, at the Limits of Contract.

If required in the Project Specification, insulating flanges shall be provided in accordance with the type Drawing Provided.

2.3.6 Position Indicators and Limit Switches

All valves other than control valves, which are fitted with drop-weights shall be fitted with position indicators which clearly show the degree to which the valve is open. Fully closed and fully open positions shall be indicated as "closed" and "open" respectively.

Reflux valves shall have no external moving parts except the position indicators.

Valves shall be fitted with limit switches when specified in the Project Specification.

2.3.7 Electric Actuators and Manual Valve Operation

When specified, in the Project Specification, the valves shall be fitted with electric motor driven flood-proof IP.67 actuators of robust design, capable of closing the valves under all unbalanced pressures in both direction of flow up to the pressure rating of the valve flanges.

The Tenderer shall state the maximum torque required to operate the valve in his Tender. In determining this maximum torque an allowance shall be made for any deterioration that could be expected to occur in the bearings during the life of the valve. The actuator shall be capable of transmitting twice this maximum torque without any of its components suffering permanent damage. This shall be proven to the Engineer's satisfaction by workshop tests.

The actuators shall be capable of restraining the valve in any position under all possible conditions of operation, and shall not, in any circumstances, be capable of becoming self-motorised as a result of the dynamic torque loading on the disc or plunger.

All gearing shall be manufactured in accordance with BS 436 Class C and shall be machine cut. All components requiring lubrication shall be adequately lubricated and totally enclosed flood-proof casing fabricated in cast iron and/or die cast aluminium to suit the service weather proof casing whether the valve is to be installed in the open or under cover. Actuators shall also be fitted with mechanical stops to prevent excessive turning and shall be provided with overload trips.

Handwheels shall be fitted to all actuators. The direction of rotation to close the valve shall be clockwise when viewed from above the end of the input shaft and from the position of operation. In addition, they shall be clearly and indelibly marked with an arrow showing the direction of closing and the word "Close".

For manually operated valves, the maximum force required to turn the handwheel at the maximum torque defined above shall not be greater than 100 N per hand at the handwheel rim. (Total effort = 200 N). In the case of actuator driven valves, this figure may be increased to a maximum total of 300 N. For large valves the minimum of complete revolutions of the handwheel to move the valve gate from fully open to fully closed shall not be less than 100.

All electric actuators shall be provided with reversing contactors; local and remote control shall be provided; a device making the local control non-operative shall also be provided on the relevant remote control panel.

When equipment is to be delivered by rail, after factory tests, the actuators shall be removed from the valve and delivered to Site in separate boxes to safeguard against damage.

2.3.8 Sluice Valves

2.3.8.1 General

- Double flanged, wedge-gate, internal (non-rising) spindle sluice valves are required arranged with hand wheels for clockwise rotation to close.

- Only full-way (i.e. the gate must be completely clear of the waterway in the open position) valves are acceptable.

Standards : valves shall comply with SABS 664 where applicable. Larger valves shall comply with BS 5163 as far as possible.

By-pass valves : unless otherwise specified in the Project Specification, main pumpline isolating valves shall be provided with by-pass sluice valves and these valves shall be bolted to the adjoining pipework. The size of the by-pass valves shall allow acceptable filling times.

Position indicators shall be fitted to all sluice valves in the main pumpline and shall have Closed, 1/4, 1/2, 3/4 and Open positions marked.

2.3.8.2 Materials and construction

- The valve body, bonnet, thrust dome, gate and glands shall be of meehanite cast iron or cast steel and the trim shall comply with clause 3.5.5 of SABS 664, either Type 'B' or Type 'C', all as may be required by the nature of the service and the pressure rating of the valve. The stuffing box shall be of ample depth to afford sufficient space for long period packing and the design shall be such as to allow the gland to be easily and conveniently repacked under pressure.

- Body and gate sealing rings shall be of bronze, gunmetal or stainless steel.

- Spindles shall be of high strength bronze or stainless steel except where gearing is required when the spindles shall be of stainless steel. The valve bodies shall be designed to withstand the additional stresses imposed by the actuator gearing.

- Valves other than the main pumpline isolating valves shall be designed to be handwheel operated. The maximum force required to turn the handwheel at the maximum torque defined in Clause 2.3.7 shall not be greater than 200 N at the handwheel rim when operating at an unbalanced pressure equal to the rated working pressure of the valve, and is to be confirmed for each valve type offered. This may be achieved with the aid of gearing of a suitable ratio. The pinion spindle shall be of mild steel or better, fitted with a gunmetal bush.

2.3.9 Butterfly Valves

2.3.9.1 General

These shall be horizontal spindle type butterfly valves complete with gearing, handwheels and flanged at both ends with separate bolting for joining to the adjacent pipework, Wafer type valves with bolt holes passing right through the adjacent flanges or valves fitted with studs for attachment to the adjacent flanges are not acceptable unless specifically accepted in writing by the Engineer.

Standard: Valves shall comply with BS 5155 where applicable.

By-pass valves: Unless otherwise specified in the Project Specification, all main pumpline isolating valves, whether butterfly or sluice valves, shall be fitted with by-pass sluice valves and these valves and their associated pipework shall be bolted to the pipework adjacent to the main valves.

2.3.9.2 Materials and construction

- The valve bodies and discs shall be of high-grade cast-iron, cast or fabricated steel.

- The disc shaft or stub-shafts shall be of stainless steel located in self-lubricating bearings.

- The valves shall be drop-tight when closed and metal-to-metal sealing is not acceptable. The valve water-seal shall be of the following types:

  (a) a resilient seal fixed to the edge of the disc by securing elements fabricated of corrosion resistant material sealing on a stainless steel or bronze insert fixed in the body;

  (b) a resilient seal fixed to the body of the valve by securing elements fabricated of corrosion resistant material sealing on a stainless steel or bronze insert fixed in the edge of the disc.

- All resilient seals shall be removable and readily replaceable on Site.

- Resilient seals shall be retained by corrosion resistant securing elements to prevent corroding in position (e.g. bolts, set screws, etc).

- All moving parts requiring lubrication shall be provided with grease nipples.

2.3.10 Auto-Closing Control Valves

Control valves may be either ring needle valves or spherical ball valves as required in the Project Specification.

Operation of the pumpset with the auto-closing control valve: Refer to valve requirements, Clause 2.3.2.

Functions: The valves shall fulfil the following functions

- Electrical operation (isolating and control) suitable for opening and closing against the specified pressure and for continuous operation in any intermediate position.

- Automatic as well as manual mode control.

- Automatic reflux action for quick closure by means of drop-weight and hydraulic dash pot in case of power failure or motor protective tripping.

- Adjustable closing time and adjustable closing characteristic.

Design and material

The Tenderer's offer shall comply generally with the following specifications, but alternative offers will be considered.

- The valve body shall be of spheroidal graphite iron or cast-steel with supporting feet. The body seat shall be of stainless steel and shall be replaceable or may be deposit welded on a removable body section.

- For ring needle valves the piston (plunger) shall be of cast stainless steel with replaceable resilient seal to obtain drop tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws.

- For spherical ball valves, the eccentrically supported ball plug shall be of cast stainless steel or spheroidal graphite iron with replaceable resilient seal to obtain drop-tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws. The valve body shall include an access door to permit adjustment or replacement of the valve seal without dismantling the valve.

- The totally enclosed flanged-on gearbox shall include the following:

  - either an electro-mechanical unit comprising:

    - a totally enclosed brushless electromagnetic gear clutch for quick closing;
    - a totally enclosed directly mounted electric valve actuator with integral electric controls and auxiliary handwheel for manual operation;

  - or an electro-hydraulic unit comprising:

    - an oil hydraulic lift cylinder for opening the spherical valve;
    - a totally enclosed directly mounted electric driven oil pump and oil reservoir. The oil pump and reservoir may be individually mounted on each spherical valve or a centralised system may by employed to feed more than one valve and/or pumpline;
    - a solenoid operated hydraulic control valve which shall be de-energised to initiate closure of the spherical valve.

  - either of the above actuators shall also be provided with:

    - limit switches for signalling the "open", "closed" and intermediate "10%" positions and further control functions as required;
    - a directly mounted oil hydraulic dashpot with the necessary control valves for adjusting closing time and operating characteristic;
    - means to operate the valve manually;
    - valve shaft (stub shafts) of high tensile stainless steel located in bushes of zinc-free bronze;
    - a drop weight lever arm of steel with adjustable cast iron drop weight. The lever arm shall be keyed or splined to the shaft.

- The overhang shaft carrying the dropweight lever arm shall be supported at its bearing housing from the foundation block.

- Travel of the dropweight shall be restrained for reasons of safety at either end of the lever arm.

<u>Operation-automation</u>

- The control valves shall be arranged for selection of either manual-electric or automatic-electric operation controlled from the pump control console. Push buttons "open", "close" and "stop" for piloting these valves, when throttling is required, shall be incorporated in each pump control console, as well as indicator lamps showing "closed" (green) "intermediate" (amber) "open" (red) positions. In addition, a selector switch "manual/automatic" shall be incorporated, the automatic position being in conjunction with pump starting. A further "test" selector switch shall be mounted inside the panel to permit manual-electric testing of the equipment without running the pumpset.

- In the "automatic" mode:

  - The valve shall open automatically from the fully closed to fully open position when the pumpset is started, likewise closing automatically when the pumpset is to be shut down. In the "manual" mode the valve shall open automatically to at least the "10% open" intermediate position, whereafter manual selection of the valve position shall be enabled.

  - Each valve shall be interlocked with the pump starter. When the pump is to be stopped, the valve shall close slowly to prevent water hammer either by means of the electric actuator or by releasing hydraulic pressure in the lift cylinder by means of control valves before the pumpset is tripped and stopped by interlocked relays.

  - Similarly, the valve shall be arranged so that the pump can be started only when the valve is fully closed. The valve shall open only when the starting operation is completed and the motor is up to speed.

- The control valves shall have automatic reflux action features to close by drop-weight, controlled by an oil hydraulic dashpot, in the event of power failure or motor protective tripping. The drop-weight shall be released by a solenoid operated clutch or a valve which is constantly energised during pumping operations. Closing time and characteristics shall be adjustable to minimise water hammer.

It shall be possible to energise the "manual" mode only when

- the associated pump is running,

- the valve is at least 10% open as indicated by the "intermediate" lamp.

- the valve is in the "test" mode as described below

Selection of the "manual" mode shall not affect the automatic reflux action.

When the opening of the valve has been set manually, the valve shall maintain this position in the absence of any further action.

"Test" mode: With both isolating valves closed and electrically interlocked, a test facility shall be provided to enable the maintenance personnel to manually operate the valve without the pumpset running by selection from inside the pump control console.

Valves shall be designed to operate free of cavitation in intermediate positions.

2.3.11 Air Valves

2.3.11.1 General

- All air valves shall be supplied with double flanged, wedgegate, internal (non-rising) spindle sluice valves for isolation, which, unless otherwise specified, shall conform in all respects to this Specification.

- Air valves incorporating screw-down isolating valves in the air valve body itself are not acceptable.

2.3.11.2 Single large orifice air valves

- Single large orifice air valves are required for the admission and release of large volumes of air at low pressure during draining or filling of the pipework.

- They shall be of the large orifice ball-controlled type and an inherent feature of their design must ensure that the ball does not get caught up in the escaping air stream and close before all the air has been released when discharging large volumes of air at high rates of discharge.

Small orifice air valves: These shall be mounted at points where air could become trapped during pumping operations.

All automatic air release valves shall discharge into separate drainage pipes so as to prevent the spraying of water over equipment inside the pumpwell.

Air cocks: If required, air cocks of a suitable type shall be provided complete with suitable drainage pipes.

Location: Air valves shall be fitted to high points of the pipework and of the pumps in order to ensure trouble-free automatic operation of the whole plant when operating under normal conditions.

Materials and construction: The valve bodies, covers and shield plates (large orifice) shall be of meehanite cast-iron. The ball shall be vulcanite (or other approved material) covered, closing on to a rubber seating.

2.3.12 Reflux Valves

Reflux valves shall be double flanged and comply with SABS 144 except that cast steel bodies shall be used when the design pressure dictates.

Reflux valves of nominal bore larger than 500 mm shall be of the multi-door swing-door type with rapid closing characteristics so as to close completely just prior to the reversal of flow assuming this reversal takes place after 1,5 seconds. The inclined angle of the seat from the horizontal centre line of the valve shall not be greater than 60 degrees.

Reflux valves of the single tilting disc (not single swing door) inclined seat type shall also be considered provided the Manufacturer submits, with his Tender, guaranteed information confirming that the valves closing time is less than 1,5 seconds.

The pressure rating shall be at least equal to the design pressure in the delivery manifold.

For all pressure ratings both the valve body and doors or disc shall be fitted with replaceable stainless steel body and door seat rings. The replaceable components shall be securely fixed in such a way that they cannot work loose nor water find its way behind them in operation and preferably be of screwed-in and pinned type. It shall also be possible to replace them easily. Pressed in seats will not be acceptable.

Alternately the seat face material may be deposited by welding.

The design of the valve body and body seats shall be such that foreign objects such as bolts etc. which could lodge themselves in pockets on the downstream side of the body seats would not prevent the doors from closing fully.

Substantial stops or an approved resilient material shall be fitted into the body to prevent the doors from fluttering under full flow conditions.

The swing doors or disc shall be cast with integral hinge lugs. Continuous stainless steel door spindles shall be used and adequately secured to the hinge lugs. Dowel and taper pins if used shall be mechanically secured.

Door spindle sleeves and thrust bearings of carbon impregnated phosphor bronze shall be fitted in the hubs of the valve body. These bearings shall be of the self-lubrication type with a proven record of service of not less than 5 years. They shall have a low coefficient of friction and the possibility of their becoming tight during service shall be eliminated.

Valves shall be suitable for vertical or horizontal operation depending on the Tenderer's pipework layout.

The position of the door shall be indicated by an external pointer in valves larger than the 200 mm diameter.

2.4 PIPEWORK

2.4.1 General

Unless otherwise specified in the Project Specification, the main pipework to be supplied under this Contract starts upstream of the isolating valves on the suction manifold and ends downstream of the isolating valves on the delivery manifold. Pump manifold and pipework details shown on the layout drawings (even if not included in the Contract) can be changed in order to fulfil the pump requirements on the suction side and to keep the head losses within an economical range. If the Tenderer proposes a better pipework arrangement, he shall include in his Tender a drawing to scale of this proposed pipework. Special attention shall be given to the manifold branch pieces and to the taper pieces.

Flanges are to be drilled off-centre and shall be in all respects as required for valve flanges (see Clause 2.3.2).

The Contractor shall check the position of all pipework at all stages of erection, in particular immediately after any pipes have been cast into concrete.

2.4.2 Pipework Layout Details

Sufficient dismantling joints shall be provided which shall be tied after erection.

No unbalanced thrust must remain unsupported under any pumping conditions. The pumps shall be free of any stress induced by the pipework.

No loads other than that imposed by its own weight and blade loads shall be imposed on valve bodies.

Sufficient blank flanges shall be provided for use during the absence of any element(s) from the system and at the ends of pipework where required allowing the uninterrupted functioning of the station. Blank flanges shall be designed to withstand the given working pressure.

In order to reduce the head losses, any changes in velocity and direction along the main hydraulic circuits shall be very gradual, especially when velocities are decreasing. On the suction side of the pump, if required, reducers shall be eccentric with upper part of the pipe horizontal.

All portions of pipework situated between isolating valves shall be fitted with drain and air valves whose sizes shall allow reasonable draining times; by-pass valves on all isolating valves shall also allow reasonable filling times of the above mentioned portions of pipework.

The Contractor shall be responsible for defining the magnitude and direction of all unbalanced thrusts, which must be resisted by concrete blocks to be provided by others.

2.4.3 Cast Iron Pipes

All pipes and specials, bellmouths and bends embedded in concrete, which cannot be drained in order to carry out internal painting, shall be made of cast iron to BS 1452 minimum grade 14 or other approved corrosion resistant material as may be specified in the Project Specification.

Thrust collars must be provided to ensure stable location in the concrete and to absorb any thrust.

The castings must in all respects be sound and free from defects. They must be neatly dressed and carefully fettled so that rough places are removed, and all surfaces must be smooth. Castings must not be "stopped" or repaired in any way; repaired castings will be rejected by the Engineer.

2.4.4 Steel Pipes

All steel pipes, specials and fittings required under this Contract shall be in accordance with all the standards given in Clause 1.1.1.6.

For coating and lining see Clause 1.2 on corrosion protection and testing of coatings.

2.4.4.1 Stress and design criteria

(a) Wall thicknesses shall not be less than the following:

Outside diameter (mm)			Minimum wall thickness (mm)
219,1	-	558,8	4,5
609,6	-	660,4	5
711,2	-	812,8	6
863,7	-	1 092	8
1 118	-	1 245	10
1 397	-	1 620	12
1 708	-	1 860	14
2 020	-	2 178	16

(b) The design pressures are specified in the Project Specification and Drawings.

(c) The pipes and specials shall be made from steel plates complying with the chemical and physical properties of:

- BS 10/201, yield stress 207 MPa (30 000 psi)
- API 5L Grade B, yield stress 241 MPa (35 000 psi)
- API 5L x 42 yield stress 290 MPa (42 000 psi)

(d) The following criteria shall apply for steel stress:

- all piping supplied under this contract shall be tested to a hydrostatic pressure such as to produce a circumferential tensile stress in the steel of not less than 75% of the yield stress;
- the maximum design stress in the piping under the specified design pressure shall not exceed 2/3 of the actual stress induced by the hydrostatic test pressure;
- the maximum design stress shall not exceed 50% of the yield stress.

2.4.4.2 Welding

(a) The height of the internal weld reinforcement shall not exceed 1 mm. Any excess shall be removed by grinding.

(b) The expense of testing the pipes and specials shall be borne by the Contractor.

(c) The standards for acceptance shall comply with the American Petroleum Institute Standards:

- for ultrasonic testing: API 5 LX,

- for radiographic examination: either API 1104 with latest amendments, or API 12 C as amended by API 650, first edition December 1961. The Tenderer shall state which standard will be adopted.

(d) Examination of welds:

- All welds shall be examined visually.

- 100% of all automatic process welding shall be checked by ultrasonic means. The sensitivity of the system shall be such that flaws within the standards mentioned in subparagraph (4) below will be detected. The test apparatus shall be calibrated twice daily during any production run.

- Any sections that are suspect should further be examined radiographically.

- Where a defect is confirmed, the pipe or special shall be made good by the removal of the defective material and re-welding.

- No peening or any other artificial method of repair will be permitted, and all repairs shall be radiographed again.

- As an over-riding control on the above, radiographic examination by X-rays shall further be carried out on the following basis: 100% of all hand welds in specials and fittings, which cannot be tested hydrostatically after manufacture. 2,5% of all hand welds, covering in particular T-junctions and intersections, shall be examined radiographically.

- Where radiographic examination is not practical, as in the case of flanges welded on Site, examination using the liquid penetrant method in accordance with ASME V, article 6, shall be carried out.

(e) Repair of weld defects:

- Repair of defective welds shall follow the method described in API 650, December 1961 and all repairs shall be subject to both ultrasonic and radiographic re-examination.

- The same section of welded joint shall not be repaired more than twice under any circumstances.

- All the foregoing inspection procedure shall be subject to the supervision of the Engineer.

2.5 ANCILLARY EQUIPMENT

2.5.1 Dewatering Equipment

2.5.1.1 Description

When required in the Project Specification, two identical, automatic, fully submersible dewatering sump pumps shall be wall mounted over a collecting sump in the lowest floor of the Pump Station as indicated on the layout drawings. The pumps shall be float or electrode controlled by the water level in the sump and shall be of a reliable and robust type. The sump pumps shall deliver the water through a pipe riser to be supplied and fitted by the Contractor, to discharge through a reflux valve outside the Pump Station above high flood level. Each sump pump shall be fitted with its own individual reflux valve directly downstream of the pump delivery. It shall be possible to remove either one of the two pumps for repairs without interrupting the operation of the remaining unit.

2.5.1.2 Duty

One pump shall be suitable for discharging at least such quantity as the Tenderer considers necessary for ejecting all gland leak-off and flushing water and other leakages, and together with the second pump shall be able to evacuate the discharge from the draining of one pumpline connected to the sump within not more than one hour.

2.5.1.3 Immersion-proof operation

Both the submersible dewatering pumps and their associated sump level sensors shall be capable of operating in the event of the entire pumpwell being completely filled with water. Under these unlikely circumstances, provided that the LV switchboard itself is not also flooded, the sump pump shall still be capable of dewatering the pumpwell.

2.5.1.4 Control and alarm

Any rise in water level in the drainage sump above a predetermined level or operation of the second pump shall operate the station audible alarm (see Clause 2.6.3.9) indicating either non-functioning or mal-functioning of a sump pump. The float controls shall be set so that the second pump will come into operation before the water reaches the above mentioned predetermined level.

The arrangement shall be such that the role of duty pump can be readily interchanged. Full details of the automatic dewatering pumps shall accompany Tenders.

2.6 MONITORING AND CONTROL

2.6.1 Pump Station Control

The control of the Pump Station shall be manual, based on a predetermined number of pumps for use on a continuous basis.

Unless otherwise specified, each pumpline shall be controlled from its own control console located close to the pump(s), from which the operator will be able to see all the moving parts of the equipment in that pumpline.

All the electrically operated parts of the pumpline shall be operated from this control console, i.e. usually, the inlet isolating valve, the pump(s), the control valve and the delivery isolating valve.

Control and interlocking functions shall be provided by means of a PLC located inside the control console.

As soon as a pumpset runs, the monitoring equipment shall survey all the sensors and probes specified and:

- activate the alarm only should any limiting condition be approached within a predetermined safety margin;

- stop the pumpset/s according to the usual procedure in the event of certain non-critical defects, condition or limits being exceeded;

- stop the pumpset/s according to the emergency trip procedure together with the quick closure of the control valve by means of the dropweight in the event of any serious defect.

The control of a pumpline may be automatic only to the point that, under normal conditions (i.e. with both inlet and delivery isolating valves open) the pumpline will be started or stopped with one operation. The opening or closing of the pump delivery control valve in due time shall thus be automatically co-ordinated with starting of the pump. The same shall apply for stopping the pump line, which shall be achieved also with one operation on the control console. When operating normally, closing of the control valve shall automatically stop the pump.

Over and above this semi-automatic operation, the Contractor shall provide the plant with all the monitoring and interlocking devices necessary to prevent starting or running the pump(s) in any condition, which could be detrimental to the equipment. Some of these devices are specified hereafter, but the Contractor may provide any additional monitoring and control equipment he considers essential to the safe and functional operation of the pumping plant.

Faults causing alarms or trips, which are monitored shall be displayed on the control where all the data necessary for easy operation of the pumpline shall be displayed on the control console. Conditions monitored on the pumpline, which are designated as a fault, or are the cause of a trip condition shall be displayed on the Alarm Annunciation Panel. The data considered as indispensable is listed below in Clause 2.6.3.8, but again the Contractor may offer any additional data he considers essential.

The Contractor shall submit for the Engineer's approval a list of those defects he considers to warrant a "normal stop" and those that are more serious warranting the emergency trip procedure. On failure of any protective equipment the pumpset shall be tripped.

2.6.2 Monitoring Devices

2.6.2.1 General

The indicating or monitoring equipment shall not be affected by surges in the supply system or by portable radio transmitting equipment.

All sensors shall be compatible with the associated monitoring equipment.

Monitoring equipment shall be suitable for flush panel mounting at any angle between the vertical and horizontal planes.

Full details of the sensing equipment (thermocouples, etc)., and of the associated control and monitoring or indicating equipment shall be submitted with the tender offer. Evidence shall also be submitted that adequate spares and services are readily available in this country.

2.6.2.2 Temperature devices

It shall be the full responsibility of the Contractor to ensure that all temperature sensing devices for either motor or pump and their respective monitoring equipment are strictly compatible.

Refer to Clauses 2.1.7.2, 2.2.2.3, 2.2.2.8 for temperature monitoring of pump and motor bearings.

(a) Temperature sensors:

Either thermocouples or resistance temperature detectors shall be installed, depending on which is more suitable to the duty and application.

(b) Location of temperature probes:

- Separate temperature probes shall be installed at the sleeve and/or rolling bearings of each pump and motor and at the gland housings of the pump to monitor the temperatures at these points. If suitable, probes shall also be installed in the slots of the motor stator windings together with the coils, two per phase, to monitor motor winding temperatures as required in the Project Specification.

- The probes shall be installed in direct contact with the motor stator windings and/or shall be spring loaded to ensure positive contact with the bearing shells or gland stuffing boxes.

- Each probe shall be complete (where required) with an integral and continuous compensating lead of sufficient length to permit a neat installation between the probe and the terminal point. The compensating lead shall be adequately protected against the risk of mechanical damage.

- Each probe shall be clearly identified by means of an engraved marking on the sheath and shall be individually calibrated. Test certificates covering the calibration results of all temperature probes shall be submitted to the Engineer.

Temperature probe terminals shall be clearly marked in order to prevent inadvertent reversed readings.

(c) Temperature monitoring equipment

Temperature indicating, monitoring, alarm and trip equipment of an approved electronic type, shall be supplied for operation in conjunction with all the temperature sensors. This equipment shall include a separate temperature control unit or monitor for each sensor, together with a matching temperature indicating instrument. Both temperature controllers and indicating instruments shall have a full scale range from 0°C to 150°C and be calibrated over this range. Separate alarm and trip contacts are required for each temperature sensing control unit. The alarm and trip contacts shall close on rising temperature, and shall not cause false alarm or tripping when the supply is switched off normally or when a power supply dip occurs of less than two seconds duration.

(d) Pockets for standard thermometers

Pockets for standard mercury filled glass thermometers shall be provided adjacent to all pockets serving temperature indicating instruments. Pockets for standard thermometers shall have chained covers to prevent the ingress of dirt when not in use and shall be so arranged as to permit the accurate measurement of the bearing temperature. The pockets shall contain a small amount of oil and shall therefore be orientated within 30° of the vertical, horizontal pockets are not acceptable.

(e) Thermoswitch

Each pump casing shall be fitted with a thermoswitch, Fenwall, or equal approved make to safeguard the pump in the event of inadvertent sustained operation against a closed discharge valve. The thermoswitches shall be calibrated to close when the temperature of the water in the pump casing exceeds 40°C.

2.6.2.3 Pressure devices

(a) Pressure guages

- Each pumpset shall be equipped with two 150 mm dial diameter flush mounting pressure gauges. The gauges shall be calibrated in METRES OF WATER and the range shall suit the particular application. The gauge shall be filled with glycerine, and the bubble shall be out of the range of usual reading. The gauges shall be of a type that is possible to recalibrate (dead-weight method) and reset on Site.

- Pump discharge pressure gauges shall be capable of reading pump shut-off pressures. The gauge indicating the pump suction pressure shall have a full scale reading and be compensated for elevation.

- All pressure gauges shall be supplied and installed complete with isolating and drain cocks, piping, etc., and fitted with a pulsation snubber.

- Pressure gauges, if located on the control console, shall be mounted in a compartment totally separated from the electrical equipment. The compartment shall be equipped with a drain.

(b) Low Pressure Switch

A pressure switch, Honeywell, or equal approved make, shall be fitted to the suction pipe of each pump downstream of the inlet isolating valve, and interlocked with the pump control circuit.

(c) Pump station suction and delivery pressures

A signal derived from a suitable source on the suction manifold or pump station forebay and the appropriate tapping on the venturi flow element or other suitable source on the delivery manifold shall be utilised to indicate the station suction and delivery pressures on the Control Room mimic panel.

(d) Hydraulic snubbers

Hydraulic pulsation snubbers complete with throttle/isolating/bleed devices shall be fitted in series with all pressure sensing devises.

2.6.2.4 Pumpset vibration sensors

Suitable vibration sensors shall be mounted on each pumpset to stop it on detection of excessive vibration. At least two detectors shall be provided on each pumpset, i.e. one on the motor and one on the pump, situated as close as possible to those bearings where the highest vibration levels are encountered.

Monitoring equipment (Schenk 1 000 or equal) similar to that described in Clause 2.6.2.2(c) above for the temperature sensors shall be installed for monitoring the vibration sensors. The indicating instruments shall be suitably calibrated. They shall be of a type such that it is possible to set different tripping levels corresponding to different RMS velocities.

The monitoring of vibration shall be made via a suitable timing device in order to avoid tripping when starting the pumpset or during other transitory conditions.

2.6.2.5 Flow and power indicators, hour meters

(a) Flow measurement for the complete Pump Station (see Clause 2.6.5).

Indication and recording of total Pump Station output measured in the rising main shall be provided if specified in the Project Specification.

(b) Flow measurement for each pumpset (see also Clause 2.6.5).

- Indication of flow from each pumpset shall be as specified in the Project Specification.

- Each pumpset shall be equipped with a 150 mm dial diameter flush-mounting flow indicator on the control console.

(c) Power

The power absorbed by each main pumpset motor shall be displayed on a 94 mm square face kilowatt meter, calibrated to indicate the rated motor power, of the industrial grade complying with BS 89, wired to appropriate sources of current and potential, and mounted on each pump control console.

(d) Hour meter

A totalising non-resetable 6 digit running hour meter shall be mounted on the control console.

2.6.2.6 Additional sundry sensing devices as more fully described in the Project Specification

(a) All valves in the main pumpline (except for the reflux valve) shall be provided with both "fully open" and "fully closed" limit switches. The control valve may require additional switches to facilitate its design function.

(b) Valve actuators shall be provided with torque limit switches.

(c) A flow sensor shall be provided in the motor cooling-water circuit.

(d) Two float switches shall be provided and mounted approximately half metre above the main floor to sense the presence of floodwater in the pumpwell. Only one pair of switches need be provided per pumpwell.

(e) Any additional sensing devices as more fully described in the Project Specification.

2.6.2.7 Limit of supply

As a general rule, others supply the cabling, from a terminal box supplied and mounted by the Contractor adjacent to the pumpset. This will apply to connections between the sensing devices and the control console as well as to the Pump Station control room mimic panel.

2.6.3 Pump Control Consoles

2.6.3.1 Rated voltage

The voltage available for the control consoles will be:

- 110 V d.c. from station batteries provided by others;

- 220 V a.c. 50 Hz single phase;

or as specified in the Project Specification or on the relevant drawings.

Equipment located in the console shall be suitable for operation at any voltage within the range plus 10%, minus 20%.

2.6.3.2 General

Unless otherwise stated in the Project Specification, a desk-type console, shall be provided for each pumpset. The console shall be fully enclosed and fitted with removable panels front and rear to facilitate mounting of monitoring equipment, instruments, PLC's, interlocking relays and associated wiring. All displays, (alarm/s and trippings) and control equipment as specified, shall be flush mounted on the consoles. Engraved labels indicating the designation of each instrument, indicator lamp or control, shall be fixed below each item. Some room shall be spared to the right on the desk top to allow the operator to keep his log-book (writing area).

If two pumps operate in series, each pumpset shall be provided with all the monitoring equipment specified, mounted on one common control console. As far as control is concerned, the pump line shall be treated as a whole with only one start/stop pistol grip switch. An intermediate pressure gauge shall also be provided to register the pressure in the pipework connecting the two pumps.

The layout of the control console and the equipment contained therein shall be as more fully described in the Project Specification and to the approval of the Engineer.

2.6.3.3 Labels

Labels shall be in English and shall be of traffulyte or rear engraved Perspex. Lettering shall be in black on white background. Punched tape is not acceptable.

Each control console shall be fitted with a general information plate at least 150 mm wide made of either chrome-plated steel or stainless steel on which the following information is clearly engraved (as applicable):

- The pumpset number at least 100 mm tall.
- Pump : manufacturer, type or designation, flow capacity, speed rpm.
- Motor : manufacturer, type or designation, power kW, cooling media.
- Inlet valve : manufacturer, design, type or designation, nominal bore.
- Control valve : manufacturer, design, type or designation, nominal bore.
- Reflux valve : manufacturer, design, type or designation, nominal bore.
- Delivery valve : manufacturer, design, type or designation, nominal bore.

The plate shall be mounted on the side of the control console facing the access walkway. See also Clause 2.6.3.4 “Console cabinet”.

2.6.3.4 Console cabinet

Both the cabinet and panels shall be manufactured of sheet steel not less than 2 mm thick. The console shall be totally enclosed, IP 54, floor mounted and shall comply with BS 162. Dust proof neoprene seals shall be provided on all doors and panels. Rubber seals will not be accepted.

All panels shall be so constructed that they are flush along the front and rear and do not protrude. If extra depth is required to house a circuit, all panels shall be increased to the same depth. A 100 mm deep kick-strip shall be provided round the base. Access shall be by means of removable or hinged panels for easy access.

All doors and removable panels shall be fitted with non-ferrous fasteners designed to draw the panel closed and which are operated by means of a removable key of conventioned design. Nuts and bolts, captive screws or square keys will not be accepted.

A suitably sized undrilled removable gland plate shall be provided and located not less than 250 mm above the floor to accept bottom entry of all incoming/outgoing cables.

The entire console cabinet shall be subjected to a rust-inhibiting process before being stove enamelled, the finishing colour shall be as specified in Clause 1.2.7.1.

2.6.3.5 Mounting of equipment

All indicating or monitoring equipment as well as control equipment providing indication and setting facilities are to be flush-mounted on the consoles and all other components are to be mounted internally. At least 10% of free space shall be provided inside the console.

All components shall be inter-connected and fully wired and all connections shall be clearly identified by means of suitable numbered ferrules. All outgoing circuits shall be wired to terminal blocks comprising suitable screw connectors and situated near the base above the gland plate. All terminals shall be labelled and at least 10% free terminals shall be provided as spare.

Cables will enter the consoles from below through slots in the floor.

2.6.3.6 Indicating lamps

All pilot lamps shall be of LED type, Kimden or equal, comprising a minimum of 4 LED's per lamp mounted in a housing with 120º angle of visibility, and shall be readily available in South Africa. The LED's shall be replaceable from the front of the panel without the use of special tools. All lamps shall be of the same type unless specified otherwise in the Project Specification.

The lamps shall be clearly visible in normal daylight and shall be to the satisfaction of the Engineer.

A "lamp test" push-button shall be provided, operating on all indicating lamps mounted on that console.

2.6.3.7 Displays or indicators

Each console shall be fitted with at least the following displays:

- suction and delivery pressure gauges,
- flow indicator,
- flow totalisor;
- power indicator,
- hour-meter.
- alarm annunciation panel
- "condition" indicating lamps for each item of equipment being controlled.

2.6.3.8 Alarms/trips

The alarms and trips required are summarised below and in the Project Specification. The same general disposition of lamps and controllers as are shown in the tables shall be used on the consoles. All the required indications do not necessarily appear in these tables.

Three push buttons shall be provided on the front of the control console:

- "Alarm accept"
- "Reset"
- "Lamp test" (including all lamps of the control equipment).

INDICATING LAMPS FOR ALARMS/TRIPS (ALARM ANNUNCIATION PANEL) at least the following:

HV PANEL FAULT	EMERGENCY STOP	ELECTRICAL TRIP	MECHANICAL TRIP	COOLING WATER LOW FLOW	PUMP CASING TEMPERATURE	PUMP VIBRATION	MOTOR VIBRATION
PUMP THRUST BEARING	PUMP NDE BEARING	PUMP NDE GLAND	PUMP DE GLAND	PUMP DE BEARING	MOTOR DE BEARING	MOTOR WINDING TEMP.	MOTOR NDE BEARING
SUCTION PRESS FLOW	INLET VALVE NOT OPEN	INLET VALVE TORQUE	CONTROL VALVE OPERATING FAULT	CONTROL VALVE TEST	DELIVERY VALVE NOT OPEN	DELIVERY VALVE TORQUE	SPARE

TEMPERATURE CONTROLLERS (full scale from 0 to 150°C)

PUMP BEARINGS		PUMP GLANDS		PUMP DE BEARING	MOTOR DE BEARING	MOTOR WINDINGS			MOTOR NDE BEARING
THRUST	NDE	NDE	DE			RED	YELLOW	BLUE	

The setting of alarm/trip levels on temperature and vibration controllers shall be possible only from inside the console.

2.6.3.9 Alarm/tripping requirements

- Mechanical latching

  Each of the alarm/trip-set points shall be provided with an associated mechanical latching hand reset relay equipped with changing over-voltage free contacts with a rating of 0,5 amp at 220 V A.C. or 110 V D.C. These contacts will be used for remote indication in the event that a telemetry system is installed by others.

- Indicating lamps

  Each monitored point shall be provided with an alarm/trip indicating lamp which has to flash when the associated point reaches the pre-set alarm/trip level. The lamp will remain permanently illuminated if the fault is "accepted" This indication, together with the associated latch-in relay specified shall be re-set manually from the associated control console only and shall not be automatically cancelled if the alarm condition at the measuring point returns to normal.

- General alarm

  The station general alarm-actuated 110 V battery operated siren shall sound in the case of any alarm/trip condition occurring on any equipment installed in the Pump Station. Power shall be drawn from the station batteries to be supplied by others. The siren shall be muted only from the relevant pump control console, sump pump control panel or mimic control panel ("alarm accept" push button). See Clause 2.5.1.4 for sump pump alarm conditions.

2.6.3.10 Control equipment

The control equipment shall appear on the control console as described in the following table and in greater detail in the Project Specification. All the required controls/lamps do not necessarily appear in this table.

Equipment controlled or controller	Push buttons		Indicating lamps	
	Function	Colours	Function	Colours
Isolating inlet valve	Open Close	Red Green	Open Closed	Red Green
Pumpset (Pistol grip) (Mushroom button)*	- Start Stop Emergency stop	- - - Red	Available Running Stopped Tripped	Blue Red Green White
Control valve Auto/Manual selector (See note ** below) Valve test selector (See note *** below)	Open Stop Close -	Red Yellow Green -	Open Intermediate Closed -	Red Amber Green -
Isolating delivery valve	Open Close	Red Green	Open Closed	Red Green

Notes

* The "Emergency Stop" mushroom type self-locking push button shall be mounted on the vertical console panel so as not to be actuated inadvertently. When actuated it shall cause immediate tripping of the pumpset, and simultaneous fast closure of the control valve.

** The "Manual" position shall allow the operator to set the control valve at any intermediate position greater than 10% open while the pump is running.

*** The "Test" position shall allow testing of the control valve when the pump is not running, provided that both isolating valves are closed. The valve test selector shall be situated inside the console.

2.6.3.11 Ancillary equipment

- Circuit breakers

  The installation of all a.c. and d.c. circuit breakers shall comply with the IEC 157-1 of a type approved by the Engineer.

- Push-buttons

  Push-buttons shall have normally closed or normally open contacts as required.

  Contacts shall be capable of making and breaking 5 A at 380/220 volts a.c. unity power factor or 1 A at 110 volts d.c. with a zero time constant.

- Auxiliary relays

  Auxiliary relays shall operate on 110 volts d.c. supply and shall be capable of picking up at a minimum voltage of 85%, shall not drop out with a voltage 75% of the nominal voltage and shall withstand 110% voltage continuously.

  Contacts shall be capable of making, carrying and breaking 10 A at 220 volt a.c. unity power factor or 5A at 110 volt d.c. with a zero time constant.

2.6.4 Equipment in the Pump Station Control Room Instrument Mimic Panel

All the following equipment shall be incorporated into a suitable steel cabinet complying in all major aspects with the requirements of Clause 2.6.3.4 sufficient to mount all the instrumentation, recorders and indicators mentioned below, together with the mimic mosaic in either one or two adjacent similar cabinets, providing for the flush-mounting of the instrumentation and mosaic on the front, with rear panel or door access for installation and maintenance of the electrical components.

All instrumentation shall be wired to suitable terminal blocks located at the bottom of the cabinet which shall be mounted at eye level in the wall for access from a suitable area outside the Control Room, not floor-mounted unless otherwise stated in the Project Specification.

2.6.4.1 Pressure recorders/indicators

Pump Station suction and delivery pressures shall be recorded or indicated on suitable instruments slave-driven from suitably located transducers as detailed in the Project Specification.

2.6.4.2 Flow recorder (see Clause 2.6.5)

Station flow shall be recorded on a suitable instrument slave-driven from a transducer located either at the flow meter or housed in the Pump Station building.

2.6.4.3 Recorder charts

A six-month supply of recorder charts shall be supplied suited to the duty required by the abovementioned

recording equipment. Charts shall not require changing more frequently than once in 7 days.

2.6.4.4 Station clock/date indicator

When required in the Project Specification, a suitable panel-mounted digital quartz clock and date indicator shall be provided, either battery operated or mains operated with a 24 hour reserve against the event of power failure. Provision for resetting the clock from the front shall be provided.

2.6.4.5 Mimic panel

When required, a mosaic type mimic panel shall be provided duplicating in miniature with flush mounted 5 mm LED's the state of all pumplines in the Pump Station as displayed on each individual pumpset control console together with the condition of suction and discharge water network, reservoir levels and the like, as well as the power supply to each pumpset, the state of the HV supply, incoming feeders, bus-couplers and outgoing contractors shall all be indicated. All this information shall be arranged schematically in a logical sequence to assist the operator in his overall control function.

In addition, any alarm/trip conditions not specifically included on any of the pumpset control consoles shall be indicated, e.g. the condition of station batteries, standby electric generator, sump pumps and the like.

2.6.4.6 Additional equipment

Some other control equipment with appropriate indications may be required if stated in the Project Specification.

As described in Clause 2.6.3.8, three push buttons shall be provided on the mimic panel to perform the following functions:

- "Alarm accept"
- "Reset"
- "Lamp test"

2.6.5 Flow Meters (When Called For in the Project Specification)

2.6.5.1 Electro-magnetic flowmeters

Flow meter tubes fitted with electrodes, which can be removed for cleaning are preferred. The combined accuracy of the tube and magnetic flow converter shall be better than 1 % of the full scale reading. Preference will be given to a Tenderer guaranteeing an accuracy better than 2 % of the actual flow from 0,2 to 1,0 of the full scale reading. The converter shall have a totalisation capability with a pulse output to drive an eight digit non-resettable counter. The rate of flow output shall be 4 - 20 mA for driving a potentiometric recorder as specified below.

All pipelines are to be considered as having a non-conductive lining, so earthing/grounding rings complying to the manufacturer's specification shall be fitted on both sides of the flow meter tube.

During installation the Contractor shall ensure that no heavy duty electrical cables e.g. for pumps etc., are mounted in close proximity to electro-magnetic flow tubes or even close to the pipeline immediately upstream or downstream of the flow tube.

The converter shall be mounted within a watertight enclosure to IP67 standard and shall be placed close to the flow tube and shall be easily accessible for maintenance.

The complete installation and particularly the electric wiring shall be undertaken in accordance with the manufacturer's instructions and to the satisfaction of the Engineer.

2.6.5.2 Differential pressure producing devices

Venturi tubes, Dall tubes or orifice plates shall be manufactured to the standards required by BS 1042. This includes the installation of pressure tapping points. All pressure tapping points shall be on the side of the pipe at 45º to horizontal and D and D/2 taps only shall be used for orifice plates. Orifice plates shall be made of stainless steel. Venturi tubes and orifice plates shall be calculated in accordance with BS 1042. The relevant calculations, clearly set out, shall be supplied by the successful Tenderer.

Each device supplied shall have stamped on it where it may be easily read the information contained below, as set out in the box on the right:

-	Contract No./Item No.	W ……. / .....
-	Pipe nominal internal diameter	ID .....
-	Throat/orifice diameter	D ..... mm
-	Maximum flow rate	Q max .....l/s
-	Maximum differential head	H ..... m
-	Turndown ratio	..... m
-	Drain hole diameter (where applicable)	D ..... mm

The accuracy required of differential pressure producing devices, unless otherwise stated, is better than 1% of the full scale reading from 0,1 to 1,0 of the full scale flow rate. Tenderers unable to guarantee this degree of accuracy shall give full details of the accuracy, which can be expected.

The installation of primary devices shall be so arranged that they can be removed without the need to excavate the pipeline more than three diameters each side of the device.

Where it is required to obtain a rate of flow measurement at a point remote from the installation, a differential pressure transmitter, and a recorder and integrator shall be provided as specified below.

2.6.5.3 Differential pressure transducer/transmitters

Measuring elements of transducers shall be of the diaphragm type, and shall be capable of taking the full pressure on one side without damage, and shall be fitted with equalising valve manifolds, except on level transducers. Mercury filled instruments will NOT be accepted.

The transducer housing shall be waterproof to IP67 standard and shall be thoroughly protected against the weather. Flow transmitters shall be mounted below the pressure tapping points in a position where flooding cannot occur. If this is not practicable, they may be fitted above the tapping points in which case vent ports shall be provided. In either case, the impulse lines shall not be longer than 5 m.

The transmitter electronic unit shall be a two wire type operating from a low voltage DC power supply in series with the output signal, which shall be 4 - 20 mA.

Where signals (e.g. level transmissions) are to be transmitted over GPO lines, the Tenderer shall satisfy the Client that the equipment offered is suitable for this use and that it is acceptable to the GPO engineers.

Flow rate transducers shall have a range adjustment of not less than 5 to 1, and preferably 10 to 1. Where necessary, for instance where lower flows will occur during the initial years of a scheme, transmitters may be calibrated for an initial smaller quantity and re-calibrated for the higher flow rates later. Both flow rates and differential pressures chosen shall be detailed so that a check can be made to see that such re-calibration is possible.

All differential pressure transducers shall have an accuracy better than 0,5 % and a repeatability better than 0,2 %.

As far as possible, all differential pressure transducers offered shall have interchangeable mechanisms.

The Tenderer shall state to what extent this can be achieved. Where this can be achieved, spare mechanisms shall be priced in the Recommended Spare Parts Schedule.

2.6.5.4 Lightning protectors

All transmitters positioned external to the main building shall be protected by lightning protectors, one at the transmitter and one at the control panel. The main incoming power supply to the control panel shall also be protected by suitable lightning protectors, which shall be connected before the step-down transformer, if applicable.

All protectors are to be connected to a substantial earth to the satisfaction of the Engineer.

2.6.5.5 Installation and commissioning

All installations shall be to the standards laid down by the Instrument Society of America. The Contractor shall take special care in the numbering of cables, wires and terminal blocks, and the protection and clamping of impulse pipes.

The Contractor will be required to calibrate and commission all instruments and hand then over in full working order (see Clause 1.4.4.7).

2.7 CONTROL PHILOSOPHY

2.7.1 Pump Station Operating Philosophy

2.7.1.1 General

Before starting to operate any pumpset in the pump station ensure that any isolating valves, sluice gates etc. external to the pump station in canals, forebay or manifolds both up- and downstream of the pump station are in the open or operating position allowing a free flow of water both to and from the pump station.

Once a pumpset has been made available for service, the operation of one control only shall either start or stop the pumpset. Under normal conditions, the sequence of start-up or shut-down operations and monitoring of the pumpset and all equipment shall be fully automatic.

All installed equipment shall be protected as far as possible from known faults which could arise (such as high temperatures) by first initiating an alarm and then stopping the pumpset (by tripping the HV starter-circuit breaker) if the condition persists or becomes worse.

The necessary instrumentation shall be provided for data display, with some parameters being recorded as well, to enable the operating personnel to know exactly what the operating conditions are, such as canal levels, pump flow rates, voltages, temperatures at key points on the equipment, and other important technical information.

2.7.1.2 Control Interlocks

Before a pumpset may be started, the following parameters shall be satisfied:

- HV Circuit breaker shall be "racked in"
- No other pump shall have been started within a given time or the maximum number of starts per hour for the pumpset shall not have been exceeded.
- Both inlet and delivery isolating valves shall be fully open
- Electric motor cooling water shall be circulating
- Pump static suction pressure conditions shall be greater than the minimum required for safe pump operation

It shall not be possible to close the inlet isolating valve without first closing the delivery isolating or control valves.

Control of either of the isolating valves shall be by two buttons only: "Open" and "close". Once the "open" button has been operated it shall be possible to actuate the "close" function immediately without the need first to wait for the valve to open fully.

Should a valve actuator be overloaded, an indication shall appear on the control console, "valve torque", the alarm shall be sounded, the actuator stopped, and the pumpset tripped automatically.

Flow sensors shall be provided in the motor cooling water circuit to monitor normal operation, and shall be interlocked with the main pump control circuit.

2.7.1.3 Starting the pumpset (Manual by operator)

When all monitored conditions are healthy and the necessary control interlocks have been satisfied, a blue indication lamp, "pumpset available", shall show on the control console adjacent to the start/stop pistol grip control lever.

To start the pumpset, rotate the pistol grip lever first to the "stop" position to reset and clear the electric circuits, then rotate to the "start" position and release. The lever shall automatically return to the central position.

2.7.1.4 Stopping the pumpset

There are two stopping modes:

- Slow or normal stop - manually rotate start/stop pistol grip lever to "stop" position and release.

  First the control valve shall close slowly in a controlled fashion. When completely closed, the pumpset motor shall be tripped at the main HV breaker.

- Fast or emergency stop (tripped) - automatic operation or manual emergency stop.

  Both control valve closing and motor trip shall be initiated simultaneously as in a power failure. The control valve shall close under the combined influence of the dropweight and dashpot damping.

  If a non-return or reflux valve is specified as the control valve, there is no difference between "Normal" and "Emergency" stop modes.

2.7.1.5 Automatic monitoring function of the control console

The alarm/trip functions of the control console are intended to ensure operation of the pumpset within predetermined safe limits by monitoring predetermined vital operating conditions.

If the pre-set limit is approached in any one monitored condition, an alarm shall be sounded allowing the operator to take timeous corrective action. Should the condition continue to deteriorate, then as a final safety precaution the pumpset shall be stopped by the PLC or the control computer. The appropriate window on the on the VDU fault display shall indicate the fault.

Whether the pumpset is to be stopped normally or tripped under emergency conditions depends on the urgency and danger associated with the respective monitored function. In general, the following is a guide to how these trips are grouped:

- "SLOW" (NORMAL STOP)

Manual operation of the pumpset start-stop pistol grip control switch and the following automatic trip functions (Grouping of the alarms into either a Mechanical (M) or Electrical (E) fault is indicated):

- Inlet valve not open E
- Delivery valve not open E
- Pump bearing temperatures high M
- Pump gland temperatures high M
- Pump casing temperature high E
- Motor bearing temperatures high M
- Motor winding temperatures high E
- Cooling water flow low M
- Pump station flood water level M

- "FAST" (TRIP)

"Emergency stop"-and the following automatic trip functions:

- HV Panel fault E

ٱ	Suction pressure low	M
ٱ	Inlet valve torque	M
ٱ	Control valve operating fault	M
ٱ	Delivery valve torque	M
ٱ	Motor vibration excessive	M
ٱ	Pump vibration excessive	M

Indication of all the above conditions shall appear on the control console annunciation panel.

Also subject to a "fast" trip will be the failure of either the 110 V DC or 380 V AC power supply circuits. These are not indicated on the annunciation panel, but by separate indicating lamps on the minic panel in the control room.

2.7.1.6 Flooding protection

Where the layout of the pumpwell dictates, the pumping plant shall be protected from the ever present danger of flooding of the pumpwell.

To this end, a float switch, with backup, shall be mounted to operate should water rise higher than about half a meter above the pumpwell floor. In the unlikely event of these switches being activated, the following controlled events shall take place automatically:

- Station alarm shall be sounded with annunciation on the mimic panel.

- All pumps that are operating at the time shall be stopped in the normal mode, closing the control valves.

- All inlet isolating valves shall be closed automatically. (This clause may be waived in certain cases).

A pressure differential switch shall be mounted across the inlet isolating valve to monitor valve closure, and shall be interlocked with valve control both local at the valve actuator and from the pumpset control console, to prevent inadvertent opening of the valve.

It shall not be possible to open the closed inlet valve unless pressures on either side of the valve have been equalised. Closing of the valve shall be possible only when either one or both the valves on the pump delivery side have been closed.

2.7.1.7 Power failure

As a precaution against a power failure occurring together with a flooding threat, at least the following vital items of equipment shall be sourced from the standby generator set power circuit:

- Dewatering sump pumps
- Inlet isolating valve actuators
- Flood protection flow switches

As an added precaution, the station audible alarm shall be powered from the pump station 110V DC supply which will be unaffected by any failure of the Eskom supply.

NB: There is only one station alarm siren for all equipment installed in the pump station.

2.7.1.8 Making safe

Whenever maintenance work is to be undertaken on any component of a pumpline, the entire pumpline is to be electrically isolated. This shall be achieved at one location viz by isolating the control console. In addition, as a safety precaution, the HV breaker shall be racked out.

Interlocked with the control console isolator shall be the isolating contactor cutting off LV power to the sub-distribution board from which power is supplied to all valve actuators and other ancillary equipment on the pumpline.

Once all possible sources of power, either HV, LV or DC have been isolated and the statutory "Do not operate" signs have been displayed, a clearance certificate shall be issued by the operating staff before the necessary maintenance or repair work may be undertaken on that particular pumpline.

2.7.1.9 Control valve operation/testing

The control valve shall have three possible functional modes viz automatic, manual and test.

Selection of automatic or manual operation shall be by a switch mounted on the front of the pump control console and grouped together with the relevant control buttons for the control valve.

Selection of run or test mode shall be by a switch mounted inside the control console accessible only when the rear doors of the console are open.

Valve operations shall be as follows:

(a) Automatic

When the pumpset is up to speed on starting, and the pump pressure is registering closed-valve pressure, the valve shall automatically start to open. The movement of the valve shall be monitored at the "10% open" position and interlocked via a time relay to the running of the pumpset. If the valve has not achieved the "10% open" condition before the allotted time has elapsed, the pumpset shall be tripped and the "control valve sluggish" lamp shall show on the alarm annunciation panel.

Having passed the "10% open" mark without tripping the pumpset, the valve shall continue to open until the preset "fully open" position is achieved.

(b) Manual

Startup of the pumpset shall be the same as for the automatic mode up to the "10% open" position, thereafter any further movement of the valve, either open, stop or close shall be by manual push buttom control on the console between the limits of full open to "10% open". It shall not be possible to close the valve manually below the "10% open" position

Note :

Whether the valve is in automatic or manual mode, fully or only partially open, shall not affect the closing by drop weight in the event of a power failure.

(c) Test

It will be necessary, on occasion, to test the operation of the valve without operating the pump. In order to achieve this in safety preventing the pump from being subjected to delivery manifold pressure, the test switch shall interlock the closing of both inlet and delivery isolating valves with the manually controlled operation of the valve without the need to first start the pumpset. It shall now be possible to open and close the valve at will by means of the normal manual control buttons.

In the normal "run" position of the test switch it shall not be possible to operate the valve either in automatic or manual mode without first having started the pumpset.

PN ELECTRICAL SPECIFICATION: PUMP STATION

PN 1 GENERAL REQUIREMENTS AND INFORMATION

PN 1.1 Introduction

1.1.1 The Technical Specification covers the electrical standards, specifications, schedules and specific project requirements for the electrical engineering services associated with this project.

1.1.2 In the event that any discrepancies or indistinctness should exist in the requirements of the Conditions of Contract, Project Specification, Technical Specification, Bills of Quantities and drawings, such discrepancies or indistinctness shall be brought to the attention of the Engineer for clarification thereof prior to the closing date of the tender.

Claims for additional cost as a result of discrepancies and indistinctness in the requirements of this document shall not be entertained after the closing date of the tender.

1.1.3 It is emphasised that the electrical engineering service offered by Tenderers in their tenders shall comply in all respects with the requirements of the Project Specification and this Technical Specification. Any deviations from these requirements by the Tenderer shall be described in detail in a covering letter and shall be incorporated as an alternative tender to the main tender.

PN 1.2 Normative References

All parties are encouraged to investigate the possibility of applying the most recent edition of all standards and specifications as referred to in this document.

PN 1.3 Statutory References

1.3.1 The requirements of the Occupational Health and Safety Act, Act 85 of 1993 (OHS Act) and all subsequent amendments and regulations shall be observed and adhered to except where exemptions has been obtained from the Chief Factories Inspector.

1.3.2 Construction Regulations, 2003.

1.3.3 The Post Office Act, No.44 of 1958 and the Postmaster General's Requirements issued in terms of that Act.

1.3.4 The Electricity Act, No. 40 of 1958.

1.3.5 The Forest Act, Article 34 of Act No. 72 of 1968.

1.3.6 The Advertising on Roads and Ribbon Development Act, No. 21 of 1940 and No. 16 of 1962.

1.3.7 Explosives Act, No. 26 of 1956.

1.3.8 The South African Transport Services Safety Regulations and the regulations and bylaws of the Local Supply Authority.

PN 1.4 Climate Conditions

Item	Description	Details
1.	Altitude	1505 m
2.	Temperature	1°C to 40°C
3.	Pollution	Low
4.	Humidity	47% to 78% RH
5.	Rainfall	500mm – 750mm per year
6.	Lightning ground flash density	7.5 flashes per km^2 per year

Table 1: Climate conditions

PN 1.5 System Parameters

Item	Description	Details
1.	System Nominal Voltage	400/230 V
2.	System frequency	50 HZ
3.	Phase Rotation	To be confirmed by contractor
4.	Fault Capacity	35kA at 400 V (at Jarric substation)

Table 2: System parameters

PN 1.6 Programme, Record Keeping and Reporting

6.1.1 General

6.1.1.1 The successful tenderer shall submit his proposed construction programme to the Engineer within 14 days of his being awarded the tender.

6.1.1.2 This programme shall be in the form of a bar chart containing the following information:
(a) Projected weekly progress on site for the entire duration of the contract.
(b) Projected expenditure on a monthly basis for the entire duration of the contract.

6.1.1.3 The Contractor shall also provide an organisation chart showing the personnel to be employed for the works, along with a detailed CV of the key personnel.

6.1.1.4 If there should be any deviations to the programme be found the Contractor shall submit a revised programme to the Engineer within one week of such deviations being brought to the Contractor's attention.

6.1.1.5 Approval of any programme by the Engineer shall have no contractual status other that an indication that the Engineer is satisfied as to the order in which the work is to be carried out, and that the Contractor undertakes to perform all work in accordance with the approved programme.

6.1.1.6 The Engineer retains the right to alter any approved programme should circumstances on site necessitate such a change.

6.1.1.7 No claims whatsoever will be entertained in respect of any delays resulting from the operations of other Contractors or from any changes in programme which may be required from time to time in the interest of overall progress.

6.1.2 Record-keeping

The Contractor is responsible for implementing and maintaining a suitable record-keeping system for material and progress of all facets of the contract.

6.1.3 Reporting

6.1.3.1 The following reports are also part of the Contractor's responsibilities:

(a) Material control report - weekly
(b) Construction Progress Report - weekly

6.1.3.2 The abovementioned reporting forms are not included in the contract documentation, but will be issued to the successful tenderer.

PN 1.7 Access Roads

1.7.1 Temporary access roads, which may be required to reach various parts of his Site, will be the Contractor's responsibility.

PN 1.8 Protection of Existing Works Or Services

1.8.1 The Contractor shall take all necessary steps to ascertain the location of existing services before commencing any section of the works and shall protect and exercise the greatest care when working in the vicinity of such services.

1.8.2 No more than three weeks and not less than one week before commencing his operations on any particular site, the Contractor shall request the latest available drawings showing the location of services already installed and the latest proposals for any further services and connections to buildings, which may still be required. Should any additional services or departures from such proposals become necessary, the Contractor will be issued with drawings showing such proposed alterations.

PN 1.9 Drawings

1.9.1 Drawings which shall form part of this contract are detailed in the Project Specification.

PN 1.10 Arrangements with The Supply Authority

1.10.1 The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the Local Supply Authority unless specified to the contrary.

1.10.2 The fee charged by the Supply Authority for connection of the installation to the supply mains will be refunded to the Contractor on production of the official account or receipt.

1.10.3 It shall be the responsibility of the Contractor to make the necessary arrangements with the Local Supply Authority at his own cost and to supply the labour, equipment and means to inspect, test and commission the installation to the requirement of the local and Supply Authorities.

PN 1.11 Visit To Or Occupation Of Site

1.11.1 A compulsory tender briefing and site inspection shall be held unless otherwise arranged by the Engineer.

1.11.2 Tenderers are advised to visit the site and become fully conversant with the type and nature of the work involved, and with the local site conditions, prior to submitting a tender price. No claim arising due to lack of knowledge in this respect shall be entertained. It is essential to visit this site before tendering.

PN 1.12 Contract Work

The installation shall be carried out entirely by the Contractor's own staff and shall not in any way be sublet, unless otherwise agreed by the Engineer.

PN 1.13 Completion Of Document At Tender Stage

Should the Tenderer submit a tender and has not completed in full the Bills of Quantities, Technical Schedules and Particulars within this document, his tender cannot be adjudicated and may well be disqualified.

PN 1.14 Standard Of Work

1.14.1 All work shall comply with the acts and regulations as stipulated in the section of the Project Specification.
1.14.2 The whole works shall also be carried out in accordance with the best practices and to the satisfaction of the Engineer.
1.14.3 Uniform standards and equipment shall be maintained throughout the service.

PN 1.15 Making Good

1.15.1 The tenderer shall be responsible for the making good in all trades of any damage to buildings or other services, which he or his employees may have incurred during the construction of the new works.

1.15.2 The Contractor shall be responsible for keeping the site clean and tidy and shall remove from the site all rubble and litter resulting from the construction work.

PN 1.16 Special Tools

All special tools required for maintenance of specific equipment must be without indemnity to be handed over to the representative on completion of the contract.

PN 1.17 Test Equipment

The Contractor shall provide all test equipment required to take all measurements and readings specified or as may be required from time to time, to ensure that the installation is handed over in good working order. The test equipment shall at all times be correctly calibrated and in good working condition. All test equipment remains the property of the Contractor.

PN 1.18 Installation Work

The Contractor should notify the Engineer in time when the installation reaches important stages of completion (e.g. before closing cable trenches, before casting concrete, etc.) so that inspections can be scheduled in the best interest of all parties concerned.

PN 1.19 Balancing Of Load

The Contractor shall balance the load as evenly as possible over multi-phase supplies and shall take equipment duties such as single phase pumps into account.

PN 1.20 As-Built Drawings

Drawings will be issued to the Contractor for the purpose of marking up a set of “as-built” drawings. The complete marked up set shall be done to the satisfaction of the Engineer and shall, upon the completion of sections, be handed to the Engineer. The penultimate payment will only be made after submission and approval of all "as built" drawings for the different agreed sections of the Works.

PN 1.21 Inspection And Handing Over Procedure

1.21.1 Inspection by Contractor

When an assessment stage or section of the installation is completed, the Contractor shall conduct an inspection to satisfy himself in general that the installation has been completed to the requirements of the specification and that the workmanship complies with the expected standard.

1.21.2 Testing by Contractor

Upon completion of the assessment stage or section at the site, the Contractor shall perform all tests as specified or as required by the engineer to ensure that all equipment, cabling have been connected correctly, and that the installation is ready for handing over and putting into regular service. The Contractor shall provide all test equipment.

1.21.3 Inspection and testing by Engineer

i. After the Contractor has conducted the abovementioned inspection, he shall apply in writing to the Engineer for a handing over inspection. At least 4 days notice shall be given. The following forms will be issued to the contractor and shall be thoroughly completed by the contractor:
   (a) Notice of Commencement of Installation Work
   (b) Application for Inspection
   (c) Certificate of Acceptance
   (d) Certificate of Compliance by an Accredited Person

ii. Should the completed work not pass the inspection, the Contractor shall rectify the fault[s] and apply for a re-inspection. One (1) re-inspection on a section of the work or transformer area as a whole, shall be conducted free of charge. The Contractor shall incur a penalty of R500-00 (Five Hundred Rand) for all subsequent re-inspections required on the contract and this amount will be deducted from the next payment due to the Contractor.

PN 1.22 Material And Equipment

1.22.1 All material and equipment shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards or where no such standards exist, with the relevant current Specification of the British Standard Institution.

1.22.2 All material and equipment shall be of high quality and suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which materials are installed, stored and used. Should the materials not be suitable for use under temporary site conditions then the Contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

1.22.3 The Contractor shall, where requested to do so, submit samples of equipment and material to the Engineer for approval prior to installation. The Engineer may retain these samples until the contract is completed after which they will be returned.

PN 1.23 Facilities For Contract Personnel

1.23.1 Toilet facilities

The Contractor shall provide for the supply and erection of proper temporary latrines for the use of his employees, to the satisfaction of the engineer's representative. The Contractor shall maintain the latrines in a thoroughly clean and hygienic condition for the duration of the contract.
On completion of the contract the Contractor shall remove these temporary latrines from site.

1.23.2 Electrical power for construction

The Contractor shall provide all electricity required for the execution of the works at his own expense.

1.23.3 Water for construction

The Contractor shall provide water required for the execution of the works at his own expense.

1.23.4 Construction camp

The Contractor will negotiate his own site for the establishment of a site office and store. The Contractor shall be responsible for keeping the area neat, tidy and clean. On completion of the contract all temporary buildings, roofs, fencing, etc., shall be removed from the site at the Contractor's expense and the camp site restored to the satisfaction of the Engineer.

PN 1.24 Storage Accommodation

1.24.1 The Contractor shall at his own cost provide and maintain adequate and suitable storage of all perishable or corrodible materials and fittings on sites and shall be approved by the Employer.

1.24.2 Such storage accommodation, particularly in the case of cement stores, shall be ventilated weather and waterproof, with floors raised off the ground so as to keep the materials perfectly dry and fully aerated and shall be subject to the approval of the Employer, who shall have free access at all times to the storage sheds.

PN 1.25 Guarantee and Maintenance Period

1.25.1 The Guarantee and Maintenance period shall be for one year (12 months) commencing on the date of completion for the Installation or the relevant portion thereof. During the Guarantee period the Contractor shall repair all defects in the installation, which may arise as a result of inferior quality materials or faulty workmanship.

1.25.2 The fact that the installation will be used by the Employer during the guarantee period shall in no way exempt the Contractor from his responsibility under this clause.

1.25.3 Should a no urgent fault occur during the guarantee period the Contractor will be advised and he shall repair the fault in good time.

1.25.4 Should a fault that in the opinion of the Engineer is of an urgent nature, occur during normal working hours the Contractor will be advised and he shall proceed immediately to rectify the fault.

1.25.5 Should a fault that in the opinion of the Engineer is of an urgent nature, occur outside normal working hours whilst the Contractor is not available, the Employer shall obtain the services of any available Contractor to repair the fault. The cost of such repair work shall be borne by the Contractor in accordance with the escalated tendered rates. In such a case the faulty equipment shall be kept for scrutiny by the Contractor.

1.25.6 Should the Contractor be responsible for faults and defects in the Installation during the guarantee and maintenance period the Contractor shall upon receipt of a Written Instruction from the Engineer without delay satisfactorily correct and repair all faults and defects.

1.25.7 Should the frequency of faults and breakdown in the opinion of the Engineer become so regular as to constitute and unacceptable state of affairs or should the Installation or portions thereof prove to be unacceptable, the Contractor shall upon receipt of a Written Instruction from the Engineer replace portions of components of the Installation at his own cost as prescribed by the Engineer.

PN 1.26 Beacons

1.26.1 The Contractor may in some cases have to determine the positions of electrical equipment on the basis of beacons which will be provided by the Land Surveyor. Where the Electrical Contractor is specified too do so and is unable to determine positions due to missing beacons, the missing beacons shall immediately be reported. Should equipment be installed in incorrect positions due to missing beacons, the Contractor will have to reposition the equipment at his own expense.

1.26.2 The Contractor shall also ensure all beacons are present along a cable route, before the trench is marked out and excavated. Should beacons become missing due to the filling up, the missing beacons shall immediately be replaced at the expense of the Contractor.

1.26.3 The pegs in strategic positions along a cable route shall also be verified.

PN 1.27 Explosives

1.27.1 The Contractor is to make adequate provision for blasting which, together with the necessary storage and handling of explosives, shall be carried out in strict accordance with the Explosive Act (No. 26 of 1956, as amended) and Regulations.

1.27.2 Care shall be taken that no damage is caused to existing works and property and adequate protection shall be provided to prevent blasted material being scattered about. The size of charges

shall be the minimum necessary for the purpose. The Contractor shall be solely responsible for damage and injury caused by or during blasting and shall make good at his own expense, and to the satisfaction of the Engineer, any unnecessary shattering of rock or disturbance of the surrounding ground. Careless use of explosives will render the Contractor liable to be forbidden the future use of explosives.

1.27.3 Blasting will not endanger any existing foundation, structure or service and in such situation materials must be removed by drilling and wedging or barring or by another approved method which will not cause damage.

PN 1.28 Clearing Of Site

During progress and upon completion of the Works and before acceptance and final payment is made, the Contractor at his own expense shall fill pits and clear the Works and all ground occupied by him in connection with the Works, of rubbish excess materials, false work, temporary structure and equipment, and all parts of the Works shall be left in a neat, presentable condition. All excess materials, soil, rocks, etc. shall be removed by the Contractor.

PN 1.29 Contract Standard Forms And Information

1.29.1 Standard Forms

i. Notice of Commencement of Installation Work
ii. Application for Inspection
iii. Certificate of Acceptance
iv. Certificate of Compliance by an Accredited Person

PN 1.30 General

The abovementioned forms are contained in the OHS Act & Regulations (29.1.1, 29.1.3), or will be made available to the successful tenderer. (29.1.2, 29.1.4)

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 1: LOW VOLTAGE CABLES

1. INTRODUCTION

This Technical Specification covers the standard requirements for the manufacture, works testing, supply, delivery, installation, site testing and commissioning of low voltage cable and accessories.

2. NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this Technical Specification. At the time of compilation, the edition indicated was valid. All controlled documents are subject to revision, and parties to agreements based on this Technical Specification. All parties are therefore encouraged to investigate the possibility of applying the most recent edition of the documents listed below.

SANS 1308-1:2000, Lugs and ferrules for insulated electric cables Part 1: Copper conductors.
SANS 1411-2006, Materials of insulated electric cables and flexible cords – Part 2 : Polyvinyl (PVC).
SANS 1507:2000, Electric cables with extruded solid dielectric insulations for fixed installations (300/500V to 1900/ 3300V).
SANS 10198-1:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV – Part 1 Definitions and statutory requirements.
SANS 10198-2:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 2 Choice of cable type and methods of installation.
SANS 10198-3:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 3 Earthing systems - general provisions.
SANS 10198-4:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 4 Current ratings.
SANS 10198-5:2004, The selection, handling and installation of electric power cables of rating not exceeding 33 kV - Part 5 Determination of thermal and electrical resistivity of soil.
SANS 10198-6:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 6 Transportation and storage.
SANS 10198-7:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 7 Safety precautions.
SANS 10198-8:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV - Part 8 Cable laying and installation.
SANS 10198-13:2004, The selection, handling and installation of electric power cables of rating not exceeding 33kV -Part 13 Testing, commissioning and fault location.
SANS 10292:2001, earthing of low voltage (LV) distribution systems.
NRS 028:1993, Cable lugs and ferrules for copper and aluminium conductors.
BS 6910-1:1988, Cold power resin compound and heat-shrink cable joints in the voltage range up to 1 000Vac and 1 500Vdc – Part 1: Specification of materials.

3. DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

3.1.1 Customer cable

The customer's cable, used to connect the customer's plant to the supply at the metering point. The customer cable uses a separate neutral and earth conductor, so it may be three core armoured cable (for a single-phase customer) on four core armoured cable with a separate earth continuity conductor for a three-phase supply.

3.1.2 Low Voltage (LV)

A voltage of r.m.s. value not exceeding 1000V.

3.1.3 LV feeder cable

The supplier's three-phase, LV cable to which service cables are connected, through distribution kiosks or metering kiosks, for the purpose of supplying electricity to consumers. Feeder cables are supplied by mini substations but not by ground-transformers. Feeder cables use a combined neutral and earth system, so four core armoured cables are used.

3.1.4 LV service cable

The supplier's cable, dedicated to feed one customer only. The service cable uses a combined earth and neutral, so it may be a two-core armoured cable (for single-phase supplies) or a four-core armoured cable (for three-phase supplies).

3.2 Abbreviations

Not applicable.

4. STATUTORY REQUIREMENTS

4.1 The requirements of the Occupational Health and Safety Act, Act 85 of 1993, (OHS Act) and all subsequent amendments and regulations shall be observed and adhered to except where exemption has been obtained from the Chief Factories Inspector. The requirements of SANS 10198-1 shall be adhered to.

5. TECHNICAL REQUIREMENTS

5.1 General

5.1.1 Low voltage cables shall comply with SANS 1507.
5.1.2 Low voltage cable joints shall comply with BS6910-1.
5.1.3 Low voltage cables shall be installed along routes as indicated on drawings as provided and in conjunction with the relevant cable schedules bound in this document. Only 600/1000V grade PVC, PVC, SWA, PVC copper cables shall be used for the low voltage network together with suitable connecting, terminating and jointing accessories.

5.2 Low voltage cables

The specific requirements of the low-voltage cable to be used are detailed in the table below:

Item	Description	Details
1.	Rated voltage	600/1000 V
2.	Rated area of conductors	As per cable schedule
3.	Number of cores	As per cable schedule
4.	Material of cable	Stranded copper
5.	Cable insulation	PVC
6.	Bedding under armouring	PVC
7.	Armouring	Steel wire
8.	Outer sheath	PVC
9.	Duty	General purpose
10.	Specification	SANS 1507

Table 3: Low voltage cables

5.3 Packing and marking

5.3.1 Packing

Cables shall be supplied on wooden drums with a metal flanged spindle hole suitable for an 80mm diameter spindle. Unless otherwise specified, the standard drum length shall be 500m.

5.3.2 Marking

(a) Cables shall be legibly marked in accordance with the requirements of SANS 1507 as applicable. The marking shall include the manufacturer's name, the year of manufacture, operating voltage, conductor size in mm^2 and material i.e. copper (Cu) and the specification number.
A typical legend would be:

Xxxxxxxxxxxxx CABLES	2007	600/ 1000V	185mm^2	Cu	SANS 1507

The cable shall also bear the SABS mark.

(b) The cable shall be sequentially marked at one metre intervals with the legend 000m, 001m etc. stating with 000m at the barrel of the drum and finishing with the number indicating the length of cable on the drum at the outer end of the cable. (Length marking shall be to an accuracy of better than 1%).

5.4 Low voltage cable joints and terminations

5.4.1 Joints

(a) The joints shall use the resin systems and shall be suitable for use with multi-core 600/ 1000V, PVC insulated, PVC bedding, single wire armoured and PVC sheath cable complying with SANS 1507.
(b) Joints are permitted only when approved by the Engineer. Cable joints shall be made strictly in accordance with the instructions of the manufacturer:

5.4.2 Terminating

(a) All low voltage cables shall be clamped with "K"- or "U" clamps or equivalent clamp of the correct size where needed. Should the Contractor wish to use other cable clamps than the type specified above, a sample of each size of such clamps shall be submitted to the Engineer for approval beforehand.
(b) The cable clamps shall be suitable for bringing through of the aluminium strip armouring for the termination to a cable core or to an earth terminal.
(c) The armouring shall be earthed by means of cable lugs to the earthing busbar. The individual cable cores shall be connected to the busbars of the connecting terminals by means of crimped cable lugs of the correct size. The right size of the crimping die shall be used in the crimping apparatus for the connection of the copper or aluminium wires to the cable lugs.
(d) Only lugs and ferrules of an approved type shall be used. Lugs and ferrules for the connecting of aluminium cables shall be chemically cleaned, dried and then packed in heat sealed plastic pouches to prevent the oxidation of the aluminium prior to installation. The aluminium lugs and ferrules shall be similar to BICC type HYLUG and HYLINK.
(e) The cable lugs in miniature substations and distribution cubicles shall be arranged in such a fashion that a clip-on ammeter can readily be placed around any core. The busbars in the miniature substations and distribution cubicle shall be connected from the top to the bottom to the RED, WHITE and BLUE phases respectively.
(f) Single phase cables shall be connected to the red, white or blue phase as specified in the cable schedule. The cost of all equipment and accessories for the terminating and jointing of the cables shall be added to the prices for the termination of the cables. Each low voltage terminal shall be colour true to the phase it is connected to.

5.4.3 Glands

(a) Glands to be used for terminating PVC/PVC/SWA/PVC cables shall be of the adjustable type.
(b) Glands shall be suitable for general purpose 600/ 1 000V Grade cable with steel armouring.
(c) The glands shall be made of nickel-plated bronze or brass.
(d) The glands shall consist of a barrel carrying a cone bush screwed into one end and a nickel-plated brass nipple carrying a nickel-plated brass or a heavy galvanised steel locknut screwed into the other end. The galvanising shall comply with SANS 121:2000.
(e) Non-watertight glands must be easily converted to watertight glands by means of a waterproofing shroud and inner seal kit. On the cable entry side of the barrel a concave groove shall be provided to accommodate the top rim of the waterproofing shroud.
(f) The shrouds shall be made of non-deteriorating neoprene or other synthetic rubber, and shall be resistant to water, oil and sunlight. The shrouds shall fit tightly around the glands and cable.
(g) Glands shall be provided with ISO threads and shall be suitable for the specified cable sizes.
(h) Suitable accessories shall be provided with glands to be used on ECC armoured cables to facilitate a bolted lug connection of the earth continuity conductors. Grooves cut into the barrel or cone bush to accommodate the earth continuity conductors are not acceptable.
(i) For unarmoured cables the cone bush and compression ring of the gland shall be replaced with a synthetic rubber compression bush and ring to provide the required grip on the outer sheath of the cable.

5.5 Cable Installation

5.5.1 Contractors installing cable shall be in possession of all parts of SANS 10198 and shall work according to that code of practice. Where a situation arises that is not described by SANS 10198 or this specification the Contractor shall consult the Engineer.

5.5.2 Laying of cable and installations shall be in accordance with SANS 10198-2 and SANS 10198-08 and shall be in direct burial in accordance with the Municipal or Eskom specification sheets D-DT-0854.

5.5.3 For Distribution cables the cable trench shall be installed within the road reserve at a distance of 1 m from the erf boundary.

5.5.4 MV and LV cable laid in the same trench shall be installed in accordance with D-DT-0854 (Sheet 5) or according to the Local Authorities standards.

5.5.5 Where street lighting cables or house service cables are laid separately from MV or LV power cables they shall be installed in accordance with the Eskom D-DT-0854 (Sheet 6) standard or the Local Authority's standard.

5.5.6 Cables running parallel to or crossing other services shall be installed in accordance with the Eskom D-DT-0854 (Sheet 7) standard or the Local Authority's standard.

5.5.7 Laid cable that is not immediately jointed or terminated shall be sealed by means of suitable cable end caps.

5.5.8 Inspections of trenches and cables shall be as specified for medium voltage cable elsewhere in this document.

5.6 Cable route marker

5.6.1 Cable route markers shall be a concrete block in the shape of a truncated pyramid with the following dimensions:

(a) 150mm x 150mm top;
(b) 220mm x 220mm base;
(c) 300mm high; with
(d) 105 x 105 x 5mm recess on top of cable route marker; and
(e) 100 x 100 x 2mm aluminium plate securely fixed in the recess.

5.6.2 The following shall be punched or scribed onto the aluminium plate:

(a) an arrow indicting the cable route;
(b) the cable description with a font size of 7mm; and
(c) if applicable, a "J" to indicate the position of a joint.

5.6.3 The marker shall be installed at a depth of 250mm below natural ground level and directly above the cable as follows:

(a) at each bend;
(b) at each joint;
(c) at each road crossing; and
(d) along straight section at intervals of not greater than 150m.

5.6.4 Plastic cable warning tape

(a) Plastic cable warning tape shall consist of a strip of polyethylene of thickness at least 200 microns and of nominal width 450mm, completely impregnated with a pigment such that the colour of the tape is a reasonable match to colour No. B26 (light orange) of SABS 1091, and having imprinted at intervals not exceeding 711 mm along its length, a black triangle and an electric flash symbol "DANGER, GEVAAR, INGOZI". (The tape shall be supplied in 300mm rolls).

(b) The plastic tape shall be installed directly above the centre of the MV and LV cable runs and 300mm below natural ground level.

5.7 Concrete cable slabs

5.7.1 Concrete pre-cast cable cover slabs shall have the following nominal dimensions:

(a)	Length	:	760mm
(b)	Width	:	200mm
(c)	Thickness	:	50mm

5.7.2 The slabs shall be constructed of 25MPa concrete. The concrete is to be vibrated and cured for 7 days with approved curing methods. Each slab shall have one longitudinal and three transverse mild steel reinforcing rods of nominal diameter 8mm.

5.8 Road crossings

5.8.1 Where cables cross roads it shall be installed in PVC sleeves for maintenance purposes. Sleeves shall extend at least 1 000mm beyond the edge or curbing of the road.

5.8.2 The specific requirements for the sleeves to be used are tabled as follows:

Description	**(a) Pipe Diameter (mm)**	**(a) Depth below worked off ground level (mm)**		**(a) Spare Sleeves**
		(b) Tarred Roads	**(b) Gravel Roads**	
(a) Low voltage cables	(b) 160	1 000	(c) 1 500	(a) One per crossing

Table 4: Road crossings

5.8.3 All sleeves shall be sealed with a no hardening urethane watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed. After the trench for a road crossing has been excavated, 100mm approved gravel shall be installed on top of this layer of gravel. Approved gravel shall now be installed over and around the pipes for a thickness of 100mm. The width of the trench shall be terminated to allow for at least 100mm between outer edges of pipes installed adjacent to each other. The trench shall be compacted to 93% AASHO density. The suitable backfilling shall be wetted or dried out to optimum moisture content. Compaction shall be done over the complete length of the cable duct.

5.8.4 On the road surface the backfilling shall be done to a height of 80mm higher than the adjoining ground surface to allow for subsidence of the backfilling. During the contract period and retention period the Contractor shall be responsible for the repair of any subsidence exceeding the allowed 80mm.

5.8.5 Compaction shall be done with hand tools and vibrating rollers to obtain the specified degree of compaction. During compaction the shape of the layers shall be kept constant and all holes and tracks in the layers shall be filled in.

5.8.6 Where specified that any material has to be compacted to a certain percentage AASHO it shall mean that the density of the material after compaction shall not be less than the percentage of the maximum density at optimum moisture content. The Contractor shall obtain the services of an approved testing firm to test the compaction of all road crossings. The testing firm shall supply a certificate that compaction has been done to the standard specified.

5.8.7 Where it is impossible to install cable pipes to a depth as specified below the future road level, cable pipes shall be encased in concrete. The trench shall be so excavated that there will be 150mm concrete

below, above, on the side of and between pipes. The concrete installed shall be measured in situ and shall be measured as the area of the rectangle calculated with the size of the pipes and the minimum requirements of the thickness of the concrete less the area of the cross sections of all the pipes times the length of the crossing.

5.8.8 Class 20/19 concrete shall be used in road crossings and means concrete with acute crushing strength of 20mPa at 28 days and a maximum size of coarse aggregate of 19mm.

5.9 Tests

5.9.1 Works tests shall be conducted on all cable prior to delivery to site and certified copies of type tests shall be submitted by the tenderer in accordance with SANS 1339.

5.9.2 Cable accessories shall be tested in accordance with clause 5 of NRS 053 and certified copies of type test certificates and reports shall be submitted by the tenderer. The type test reports shall include an installation instruction and schedule of materials that form an integral part of the test report issued by the test authority.

5.9.3 The testing, commissioning and fault location of cables not exceeding 33kV shall comply with SANS 10198-13:2004.

"The contractor and person appointed to carry out the tests specified in this technical instruction shall certify the new cable installations by completing a test certificate in accordance with Annexure A".

5.9.4 In-commissioning test in accordance with the supply authority requirements shall be performed on completion of the Works prior to hand-over.

ANNEXURE A – CABLE TEST CERTIFICATE

PROJECT NAME: ……..

PROJECT ID: ……..

PROJECT LOCATION:……..

NAME AND ORGANISATION OF INSTALLATION CONTRACTOR: ……..

……

NAME AND ORGANISATION OF PERSON PERFORMING TESTS: ……..

……

CABLE DATA

MANUFACTURER: ……

SPECIFICATION: ……

VOLTAGE (11kV/ 22kV / 600/ 1000V):……

CABLE INSULATION (XLPE / PILC / PVC): ……..

CONDUCTOR SIZE (mm^2): ……

TEST EQUIPMENT USED

BRAND: ……

TYPE: ……..

AC / DC / VLF: ……

TEST VOLTAGE AND RESULTS

Feeder name (include mini-sub / trfr name for LV feeders)	Test Voltage (kV)	Duration (minutes)	Result (pass)	Leakage current (outer sheath test) (if applicable)

Table 5: Test voltage and results – Cable test certificate

PERFORMED BY:

……

NAME, SIGNATURE AND DATE

WITNESSED BY:

……

NAME, SIGNATURE AND DATE

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 2: EARTHING

1. INTRODUCTION

This Technical Specification covers the standard requirements for the manufacture, works testing, supply, delivery, installation, site testing and commissioning of earthing installations.

2. NORMATIVE REFERENCE

The following documents contain provisions that, through reference in the text, constitute requirements of this Technical Specification. At the time of compilation, the edition indicated was valid. All controlled documents are subject to revision, and parties to agreements based on this Technical Specification. All parties are therefore encouraged to investigate the possibility of applying the most recent edition of the documents listed below.
SANS 1063:1998, Earth rods and couplers.
SANS 1411-7:2003, Materials of insulated cables and flexible cords – Part 7: Polyethylene (PE).
SANS 10199:2004, The design and installation of earth electrodes.
SANS 10292:2001, Earthing of low-voltage (LV) distribution systems.

3. DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

3.1.1 Ground
Terra Firma - The general Mass of the Earth.

3.1.2 Earth electrode
One or more conductive parts embedded in the ground for the purpose of making effective electrical contact with ground and to act as a path for the discharge of either lightning currents or fault currents.

3.1.3 Earthing system
A system intended to provide at all times, by means of one or more earth electrodes, a low impedance path for the immediate discharge of electricity energy, without danger into ground.

3.1.4 Earthed
So connected to ground as to ensure at all times an immediate discharge of electrical energy without danger.

3.1.5 Earth grid
An earth electrode consisting of a large rectangular arrangement of conductors buried in trenches and divided by longitudinal and transverse conductors into a number of smaller rectangles having mesh dimensions of the order of fie meters or greater.

3.1.6 Earthing lead
A conductor including any clamp or terminal, by which connection of equipment's earth terminal or conductor to an earth electrode is made.

3.1.7 Earth resistance
The resistance of the electrode and surrounding earth as measured between the earthing lead and ground.

3.1.8 Grid resistance
Earth resistance of the earth grid.

3.1.9 Grid current
The magnitude of the current injected into the soil by the earthing system. In the extreme the grid current equals the fault level.

3.1.10 Soil resistivity
The resistance between the opposite faces of a cube of soil having sides of length, 1 m. This value is expressed in ohm meter.

3.1.11 Abbreviations
Not applicable.

4. STATUTORY REQUIREMENTS

4.1 The requirements of the Occupational Health and Safety Act, Act 85 of 1993, (OHS Act) and all subsequent amendments and regulations shall be observed and adhered to except where exemption has been obtained from the Chief Factories Inspector.

5. TECHNICAL REQUIREMENTS

5.1 General

5.1.1 The earthing philosophy used for the medium-voltage cable system is in accordance with the principles and design criteria of SANS 10200.

5.1.2 The earthing philosophy used for the low-voltage cable system is in accordance with the requirements and recommendations of SANS 10292.

5.1.3 Earth fault indicators (EFIs) shall be supplied with all new equipment incorporating compact secondary switchgear (i.e. Type B mini-subs and free-standing RMUs).

5.1.4 Earth resistance tests at sub-switching stations and mini-substations shall be carried out.

5.1.5 A soil resistivity survey form and commissioning sheet shall be completed by the contractor for each medium-voltage equipment (i.e. mini sub and free-standing ring main unit) and low voltage distribution kiosk installation.

5.2 MV earthing and general requirements

The following shall cover the general requirements and in no way shall be seen to specify the full extent of the work to be carried out.

5.2.1 The connection of the earthing conductor to the cable armouring within a cable accessory (for example joint or termination) shall be by a type tested mechanical arrangement.

5.2.2 The armouring of the cable shall be continuous back to the substation and shall be used as an earth continuity conductor (ECC),

5.2.3 The cable armouring of all primary and secondary feeders within a switching station shall be bonded to the earthing bar of the metal clad switchgear. The earthing bar of all metal clad switchgear panels shall be interconnected and bonded to the switching station earth electrode.

5.2.4 The bonding and earthing at mini-substations shall comply with the following requirements:

(a) if there is a continuous earth continuity conductor (ECC) from the mini-substation back to the step-down station earth (through the armouring and lead sheath (if applicable) of the supply cable) an earth electrode shall be installed below the operator's feet, that ensures safe touch potentials under MV earth fault conditions. In this case the LV neutral busbar of the mini substation shall be bonded to the mini-substation earth bar, and
NOTE: If mini substations are supplied with a 70mm² copper links in parallel with a surge arrester that is connected between the LV neutral busbar and the mini substation earth bar. In this case the copper link and surge arrester arrangement should be left as supplied.

(b) if no ECC exists then an earth electrode shall be installed below the operator's feet that ensure safe touch potentials under earth fault conditions. In addition to this an MV and an LV earth

electrode shall be installed that ensures that the earth fault protection relay at the step-down or switching station will operate in the event of an MV earth fault at the mini substation. A surge arrester shall be installed between the LV neutral busbar and the mini substation earth bar.
NOTE: If mini substations are supplied with a 70mm² copper links in parallel with a surge arrester that is connected between the LV neutral busbar and the mini substation earth bar. In this case the copper link should be removed.

5.3 LV earthing general requirements

The following shall cover the general requirements and in no way shall be seen to specify the full extent of the work to be carried out.

5.3.1 The TN-C-S system earthing philosophy (see SANS10292) shall be used for all LV underground cable networks.

5.3.2 The cable armouring shall be bonded to the earth bar or earth stud by:
(a) Mechanical glands, with the gland plate bonded to the earth bar, or
(b) Lugging all of the armour wires and connecting them to the earth bar or earth stud (only applicable to existing installed equipment: all new equipment is fitted with gland plates which shall be utilized);

5.3.3 The minimum size of an earthing conductor to be used shall be governed by the maximum allowable temperature rise during current flow and practical considerations.

5.3.4 Continuity of the cable armouring shall be maintained at all cable joints by using ferrules to join all the armour wires;

5.3.5 All exposed conductive parts of a consumer's installation shall be connected to the protective conductor through the supply earth terminal and the service connection.

5.4 Earth electrodes

5.4.1 Earth electrode selection and installation procedure
The following procedures shall be followed when establishing a main earth electrode installation:
(a) AA soil resistivity survey shall be undertaken to establish suitable electrodes sites.
(b) An electrode type appropriate for the soil conditions shall be selected, and
(c) The electrode shall be installed.

5.4.2 Soil resistivity survey
The resistance to earth of an electrode is influenced by the resistivity of the surrounding soil. The measurement of soil resistivity is therefore an extremely important function and shall form an integral part of the overall earthing process. A soil resistivity survey shall be implemented as follows:
(a) The soil resistivity survey shall be performed using the Wenner Method.
(b) The soil resistivity value measured in ohm meters (Ωm) at a depth of 0,5m to 1,5m below ground level is used for the selection of an appropriate earth electrode. This depth range is important as the soil that is close to the electrode has the greatest positive effect on its final resistance value.

5.4.3 Earth electrode selection
A standard earth electrode type is selected on the basis of the required resistance value and the result of the apparent soil resistivity measurement (taken at 0,5m to 1,5m below ground level). A thee point star electrode configuration is referred.
Where the measured resistivity value does not correspond to one of the four “standard” values, 300Ωm, 600Ωm, 900Ωm and 1 500Ωm, an electrode designed for the next highest standard resistivity value should be selected. For example, if the soil resistivity survey yielded a result of 400Ωm, a standard electrode designed for 600Ωm should be selected.

5.4.4 Installation of an earth electrode

Earth electrode components are installed as follows:

(a) Horizontal conductors.
Horizontal conductors are buried in trenches no less than 500mm below ground level.

(b) Single earth rods
Each earth rod shall be driven into undisturbed soil. The general rule is that if a foundation hole can be excavated by mechanical means, then it will be reasonably easy to drive in an earth rod,
Earth rods shall be driven a minimum of 1 000mm from the structure and the rod top shall be not less than 500mm below ground level.

5.4.5 Connection to earth electrodes

Connection to earth electrodes shall comply with the following:

(a) All normally accessible earthing terminations to equipment shall be made with compression lugs or bolted clamps.

(b) All earthing connections to equipment shall be so arranged that they can be removed, permanently or temporarily, independently or any other earth; and

(c) The number of connections to earth conductor shall be kept to a minimum.

5.4.6 Material for earthing applications

(a) The conductor used for earthing leads and earth bonding conductor shall be annealed stranded or solid copper conductor. A minimum cross sectional area of 16mm^2 stranded copper or 12mm^2 solid copper shall be used.

(b) The earth leads used to obtain the separation between the MV and LV electrodes at transformer installations shall be insulated with a black, 1000V, ultra-violet stabilized, PVC covering. The PVC covering and copper shall comply with SABS 1411-7.

(c) It is preferred that all bonds within an earthing system be made via a crimped, bolted or exothermic welded connection. The following connectors are suitable for use on both copper and copper-clad steel conductors:

(i) Connections to earth rods

- Conductor to rod crimped connection (preferred)

Suitable for use with one 16mm^2 conductor and a 16mm diameter earth rod.

- Exothermic welded connection.
- Conductor to rod clamp
  Suitable for use with conductor or maximum cross sectional area of 70mm^2 and a 16mm diameter earth rod. The clamp bolt shall be tightened onto the earth rod, not the copper lead.

(ii) Connections for conductors

- Crimped ferrule (preferred)

To be used with four off 16mm^2 conductors. The ferrule is crimped using a 14.5 HEX across flats die and a half-ton hydraulic crimping tool (the same as is used for ABC joints and terminations)

- Line tap

To be used with connection of stranded conductor of diameters up to 9mm.

ANNEXURE A

(informative only)

INSTALLATION RECORD AND MV EQUIPMENT COMMISSIONING SHEET

E.1 Soil resistivity survey form

1. **Installation ref** 1.1 **Electrical address** 1.2 **Project Details**

_____ _____
_____ _____
_____ _____
_____ _____

2. **Soil resistivity survey results**

2.1 **Soil types**

_____ Loams, garden soil
_____ Clays
_____ Clay, sand and gravel mixtures
_____ Sand and gravel
_____ Slates, shale and sandstone
_____ Crystalline rocks

2.2 **Soil resistivity measurement results**

Spacing a (m)	**Specific depth D=0,8 a (m)**	**Tester reading R (Ω)**	**Geometric factor K K = 2πa**	**Resistivity (Ω x m) p = RK**
1	0,8		6,28	
2	1,6		12,57	
3	2,4		18,85	
5	4,0		31,42	
10	8,0		62,83	
15	12,0		94,25	

Table 6: Soil resistivity measurement results

2.3 **Apparent resistivity graph**

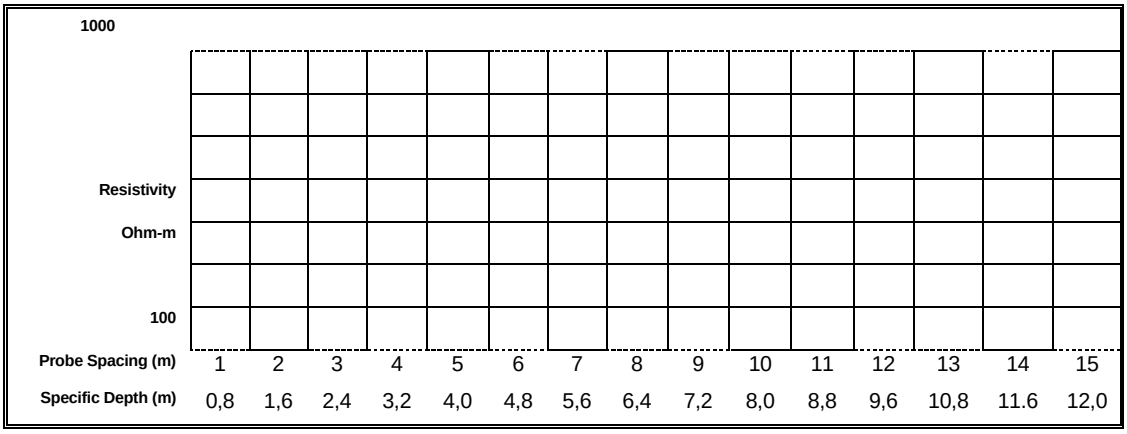

Table 7: Apparent resistivity graph

NOTES:

_____
_____
_____
_____
_____
_____
_____

Responsible person _____ (name and surname)
_____ (unique / ID Number) *
* Contractor

_____ (telephone number)
_____ (signature)
_____ Date

E.2 <u>Medium-voltage equipment commissioning sheet</u>

1. **Distributor** : _____
2. **Area** : _____
3. **Depot** : _____
4. **Installation reference** : _____

4a **Electrical address** : _____

4b **Physical address** : _____

5. **Installation details** :

_____

5.1 Electrode selection : _____

(a) Electrode Configuration

- ☐ Three point star
- ☐ Linear
- ☐ L-Shape
- ☐ Other Specify: _____

(b) Electrode dimensions (in meters)

Trench depth _____
Radial length, L _____
Rod lengths _____
Rod separation _____
Number of rods _____

(c) Comments: _____
_____

5.2 Results of electrode resistance test – 61,8 % method (if required)

Definition	Position	Distance (m)	Resistance (Ω)
X	Probe C2		
R_1	Probe P2 at 0,2 X		
R_2	Probe P2 at 0,4 X		
R_3	Probe P2 at 0,5 X		
R_4	Probe P2 at 0,6 X		
	Probe P2 at 0,618 X		
R_5	Probe P2 at 0,7 X		
R_6	Probe P2 at 0,8 X		

Table 8: Results of electrode resistance test – 61.8 % method (if required)

5.3 Results of electrode resistance test – four potential method (if required)

R_∞	**=**	**- 0,1187 R_1**	**-**	**0,4667 R_2**	**+**	**1,9816 R_4**	**-**	**0,3961 R_6**	**=**	**_____Ω**
R_∞	=	- 2,6108 R_2	+	4,0508 R_3	-	0,1626 R_6	-	0,2774 R_6	=	_____Ω
R_∞		- 1,8871 R_2	+	1,1148 R_3	+	3,6837 R_4	-	1,9114 R_5	=	_____Ω
R_∞		- 6,5225 R_3	+	13,6816 R_4	-	6,8803 R_5	+	0,7210 R_6	=	_____Ω

R(T) R(ave) =

____
____
Ω

Table 9: Results of electrode resistance test – four potential method (if required)

5.4 Equipment details

Neutral surge arrester installed: (Y / N) _____

If yes, make of arrester: _____

Drop out fuse links installed: (Y / N) _____

If yes, make of fuse links: _____

Fuse rating type _____

Transformer details

Make: _____

Vector group: _____

Serial No: _____

Transformer capacity S = _____ kVA

Responsible person _____ (name and surname)

_____ (unique / ID Number) *

* Contractor

_____ (telephone number)

_____ (signature)

_____ Date

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 3: EXCAVATIONS

1. INTRODUCTION

This Technical Specification covers the standard requirements for general excavation work.

2. STATUTORY REQUIREMENTS

The following documents contain provisions that, through reference in the text, constitute requirements of this Technical Specification. At the time of compilation, the edition indicated was valid. All controlled documents are subject to revision, and parties to agreements based on this Technical Specification. All parties are therefore encouraged to investigate the possibility of applying the most recent edition of the documents listed below.

3. PROGRAM REQUIREMENTS

3.1 General

3.1.1 Unless otherwise specified the electrical contractor will be responsible for the excavation work associated with the following:

(a) Trenches for the laying of electrical cable and electrical sleeves.
(b) Joint bays;
(c) MV and LV equipment plinths;
(d) Street lighting poles; and
(e) Road crossings shallow rivers and water channels.

3.2 Excavations

3.2.1 The Contractor shall, before trenching commences, familiarise himself with the routes and site conditions and the procedure and order of doing the work shall be planned in conjunction with the general construction programme for other services and building requirements.

3.2.2 Trenches shall connect the points shown on the drawings in a straight line. Any deviations due to obstructions or existing services shall be approved by the Engineer beforehand.

3.2.3 Crossing of any services of all other authorities will be co-ordinated with the Engineer or Employer in collaboration with the authority concerned by the Contractor. The Contractor shall liaise with the various authorities well in advance regarding the intended dates, times and expected duration of the crossing operation and obtain their approval of the programme and method of operation before commencing with the work.

3.2.4 The Tenderer shall base his prices for excavations on the following definitions of the various types of ground.

(a) Hard Rock: Will be held to be under composed boulder each exceeding a nominal diameter of 1m and solid rock in bulk or banks or ledges, the practicable excavation of which would necessitate the use of explosives and or drilling and wedging.
(b) Soft Rock (Hard Material): Will be held to be material other than rock, the excavation of which would be economically impracticable if executed by pick and shovel or by means of an ordinary "back actor" without attaching a special mechanical ripper to it. Hard material can only be excavated by either pneumatic tools or by a "back actor" with a special mechanical ripper attached to it. Hard material shall include soil with loose boulder with nominal diameters between 300mm and 1m.

(c) Pickable Material: Will be held to be material more easily excavated and not falling into the categories of "rock" or "hard material" such as gravel, earth, turf, scale, sand, silt and clay. If any stage a disagreement in the classification of excavated material exists between the Engineer or his representative and the Contractor, a third party shall be mutually agreed upon and the decision of this third party shall be obtained and shall be final. The Contractor shall acquaint himself with the nature of the material to be excavated for the Works before submitting his tender and the submission of a tender shall be deemed to be an acknowledgment by him that he has done so.

3.2.5 No guarantee is given or implied that blasting shall not be required, but should this method of removal be necessary and permitted by the Engineer or Employer then the contractor shall take all responsibility and observe all conditions set forth in Government and Local Authority regulations.

3.2.6 The Contractor shall provide all pumps and equipment required to remove accumulated water from trenches. Water or any other liquid removed shall be disposed of without any nuisance or hazard.

3.2.7 Power driven mechanical excavators may be used for trenching operations provided that they are not used in close proximity to other plant liable to be damaged by the use of such machinery. Their use along sections of the route must in each case be approved by the engineer. Should the excavator produce trenches that exceed the required dimensions, payment based on volumetric excavation rates will be calculated only on the required dimensions.

3.3 Backfilling of excavation

3.3.1 General

The contractor will be responsible to dig all cable and sleeve pipe trenches. All cable trenches must be backfilled in 150mm layers to a density of 90% MASSHTO.

Road and paved area crossings

After installation of cable sleeve pipes under roads, paved area or buildings, the Contractor will be responsible for backfilling and compaction of these trenches iin 150mm layers. This must be done to the satisfaction of the Engineer to a density of MASSHTO of 90% on bottom layers, 93% for the third layer from the top, 95% for the second layer of the top and 97% of the top layer. The third layer from the top must be of selected sub grade quality, the second from the top layer must be sub-base quality and the top layer base course quality or alternatively the three top layers can be stabilised with 7% cement and compacted to the required densities. All test to prove the density of layers will be for the account of the contractor.

3.4 Inspection of trenches

3.4.1 All trenches shall be subject to the following inspections to be arranged with the Engineer:

(a) After excavation prior to bedding soil being placed;
(b) After the bottom 150mm thick bedding soil being placed prior to laying of cables, sleeves and/or ducts;
(c) After the cables, sleeves and/or ducts have been laid;
(d) After backfilling, compaction and placement of protective slabs (if applicable).

3.3.2 Should the Contractor not meet with this requirement, or if he fails to give the Engineer sufficient notice of an inspection, portion of the trenches or the complete trench shall have to be re-excavated by the Contractor at his own expense for inspection purposes, as required by the Engineer.

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 4: LOW VOLTAGE MOTOR CONTROL CENTRES

1. PURPOSE

1.1 This standard specification covers the requirements for low voltage distribution switchboards.

2. GENERAL

2.1 All details, dimensions and instructions shown on any drawing, diagrams and standards quoted herein shall be taken as forming part of the requirement.

2.2 If there is any discrepancy between drawings, standards, standard specification, project specification and tender document, the Project Specification shall be followed.

2.3 This standard indicates the special minimum requirements of the Employer. Where no specific requirement is indicated or where “not applicable” is indicated under a heading, it does not relieve the manufacturer/supplier/tenderer of any statutory or common law duty and the manufacturer/supplier/tenderer will comply with any requirements or standards from any statutory body for the specific product.

3. INSPECTION AND STANDARD

3.1 The contractor shall prove that a quality assurance system in accordance with the international standard ISO 9001 is available by the manufacturer of the distribution switchboards, if the Employer so calls for it.

3.2 The Employer reserves the right to arrange for the inspection of all goods forming the subject of any order or contract, at any stage before final acceptance and by any means it may think fit, and when such inspection is to be carried out, the relevant contracts, orders and suborders shall be endorsed accordingly.

3.3 The contractor shall supply, without charge to the Employer all tools, gauges, templates, test pieces, samples and specimens and other equipment (including load banks) which may be required for checking the accuracy of the work; shall provide the labour necessary for inspecting the work in accordance with requirements specified in the contract or order and shall render all reasonable assistance in carrying out this checking and inspection.

3.4 The contractor shall be able to do all witnessed tests and/or training in South Africa. Any requirement for overseas visits shall be to the contractors account. The Employer shall not be responsible for funding overseas visits nor shall such be included in the price of the system.

4. DETAIL INTERPRETATIONS AND CLARIFICATIONS

For any interpretations, clarifications, explanations or uncertainties please contact the Engineer.

5. CERTIFICATE OF COMPLIANCE

5.5.1 The tenderer shall indicate, section by section, whether or not the quotation/tender complies in every respect within this requirement.

5.5.2 The tenderer must clearly indicate to what and to what extent does his offer comply, merely stating comply is not acceptable.

5.5.3 Full compliance sheets shall be submitted for companion standards referenced in this standard.

5.5.4 The tenderer shall not refer to any attached manuals, pamphlets or data sheets. (Manuals and pamphlets may be used to amplify statements).

5.5.5 If alternative quotations/offers are submitted, all divergences from this requirement shall be clearly stated, along with a motivation for offering the alternative.

5.5.6 A separate compliance certificate shall be submitted for each alternative offer.

6. SWITCHBOARD CONSTRUCTION

6.1 General

6.1.1 The Contractor must ascertain the positions of all switchboards timeously and ensure that provision is made in the structure for sleeves, pipes, access holes, etc. as required.

6.1.2 All switchboards shall be totally enclosed, vermin and insect proof, drip-proof and dustproof to at least class IP 54 of IEC 144.

6.1.3 Surface mounted switchboards shall only be used where they are not larger than 1 200mm wide x 1 200mm high and the mass is such that the switchboard can safely be mounted with four (4) expansion type bolts on the surface of the wall. All other switchboards shall be of the floor standing type.

6.2 Surface Mounted Switchboards

6.2.1 The switchboard shall consist of a 2mm sheet metal enclosure, suitably braced with the necessary reinforced fixings for wall mounting. All joints shall be welded. A 20mm front edge, beyond which no equipment must protrude, shall be provided.

6.2.2 All equipment shall be mounted on a strengthened chassis, solidly fixed to the enclosure.

6.2.3 The front shall be covered by a hinged panel(s) with machine punched slots and holes for the flush mounting of circuit breakers, instruments, indicator lights, pushbuttons, etc. Contactors, motor protection units, etc. shall not protrude beyond the panel. Instruments, indicator lights and control pushbuttons can also be mounted on the panel(s). The panel(s) shall have a square key operated lock solid hinges and chromium plated handle. All front panels shall be hinged. Removable front panels with retaining pins and latch are not acceptable.

6.3 Floor standing switchboards

6.3.1 Floor standing switchboards shall be totally enclosed, fixed pattern multitier boards built in sections allowing for the logical grouping of equipment behind individual hinged panels. All switchboards shall be suitable for mounting against a wall and shall provide for front access to all equipment and terminations but side, top and rear panels shall also be removable.

6.3.2 The switchboards shall consist of a solid angle iron, channel iron or 2mm minimum folded metal framework and solid U-channel base frame, sufficiently braced to support all equipment and span floor trenches and access holes. The maximum height of the switchboard shall be 2,1 meters.

6.3.3 Top, side and rear removable panels of 2mm minimum steel shall be fixed with studs and chromium plated brass dome nuts and washers or hank nuts and bolts.

6.3.4 Access to all sections of the switchboard shall be via hinged front panels consisting of 2mm minimum sheet steel with square key orated non-ferrous fasteners designed to draw the panel closed. Panels fixed by nuts and bolts or captive screws are not acceptable. Unhinged panels with retaining pins and latch are not acceptable. Hinged panels shall be dished with 20mm upturns and be equipped with rubber or neoprene seals. The panels shall be suitably braided and stiffened to carry the weight of flush mounted equipment and to prevent warping. Long pedestal type or similar hinges with two bolts per hinge shall be used on all hinged panels for flush mounted protection relays and on panels higher than 600mm. Three hinges shall be provided on panels higher than 1,5 meters. Hinges with single bolts may be used on smaller panels. Hinges shall be arranged in opposed fashion so that panels cannot be lifted off.

6.4 Busbars

6.4.1 The busbars shall be installed at the top of the switchboard with sufficient access even when the board is installed against a wall. Busbar connection to equipment ("droppers") shall be insulated thoroughly and shall be suitably braced along its entire length to withstand the maximum fault current which may be encountered.

6.4.2 The insulating material shall withstand the maximum fault level encountered.

6.5 Cable Access

6.5.1 Adequate space shall be provided at the rear of switchboards for power cables and busbars for equipment. The cable connections and busbars shall be accessible from the front of the switchboard.

6.5.2 Conductors for control, instrumentation, monitoring, alarm and low voltage supply circuits that are bunched and bound or installed in PVC wiring channels, shall be installed along the sides of the individual switchboard sections and shall be accessible from the front.

6.6 Gland Plates

6.6.1 Sturdy gland plates to accommodate all power cables shall be provided within 300mm of the bottom of the switchboard. The correct size of hole to accommodate cable glands shall be installed on site by means of chassis punches. The board shall be provided with a "unistrut" P4000 or other approved support for cables to relieve the glands of mechanical stress.

6.7 Terminations

6.7.1 Terminals for all outgoing control, instrumentation, monitoring, alarm and low voltage supply circuits shall be located at the bottom and/or top of the switchboard and shall be accessible via hinged front panels. These terminals shall be installed away from terminals for power circuits. All outgoing circuits must terminate on numbered terminal strips equal or similar to "WIELAND", "KLIPPON", "LEGRAND" (VIKING)", or "ENTRELEC".

6.7.2 The correct terminal size shall be used for each conductor. Only one conductor per terminal will be allowed. Bridging contacts on the terminals shall be used for parallel connected circuits.

6.7.3 All outgoing power cables shall terminate within 300mm of the gland plate to avoid long leads. If this is not possible in certain instances each lead must be separately braced.

6.7.4 Power cable sized up to and including 70mm² may terminate on clamp type terminals where the clamping screw is not in direct contact with the conductor. Connection to the equipment can then be made with cables that are similarly connected to the clamp terminal.

6.7.5 All power cable sizes larger than 70mm² shall terminate on busbars that are connected to the associated equipment. Conductors shall have lugs that are sweated or crimped and bolted onto busbar ends by means of cadmium plated steel bolts, nuts and lock washers.

6.7.6 All switchboards shall be thoroughly vermin proof.

6.8 Isolation of Incoming Supply

6.8.1 Each switchboard shall be provided with a means to isolate the incoming supply. This may be achieved by the use of an isolator, circuit breaker (fixed or draw-out) or fuse switch, rated to make against the full system fault at that point and break the full load current.

6.8.2 The incoming supply section containing switchgear, protection equipment, controls and instrumentation shall form a clearly labelled, self-contained unit behind one or more hinged panels. The operating handle of the isolator, circuit breaker or fuse switch controlling the incoming supply shall protrude through the panel and shall be interlocked to ensure that the panel can only be opened when the supply is off.

6.8.3 All instruments, timers, pushbuttons and other controls shall be visible and be operated from the front without having to open the panels.

6.8.4 Equipment that cannot be flush mounted on the panel shall be mounted on a suitable metal chassis and shall protrude through a close fitting cut-out in the panel. All protection relays contained in enclosed contactors, thermal overload units, etc., shall be mounted on a chassis behind the panel with reset pushbuttons with shaft extensions mounted on the panel where applicable.

6.9 Motor Controls

6.9.1 The switchgear, protection and control equipment, instrumentation and monitoring equipment of the supply circuits to motors or other electrically operated mechanical equipment shall be grouped separately in the switchboard. Large switchboards shall be provided with individual compartments or sections in the switchboard for each subsystem, e.g. compressor, cooling towers with pumps and fans, etc. The equipment may be arranged in a multitier fashion with hinged panels having varying vertical dimensions but the same horizontal dimensions to accommodate different equipment ratings.

6.9.2 Each motor circuit shall be provided with a positive means of isolation. A clutch type operating handle interlocked with the hinged panel to open in the “off” position only, shall be provided for isolators or moulded case circuit breakers that are not flush mounted. Withdrawal circuit breakers shall be mounted behind separate hinged panels. Where combination fuse switch units are used, these shall be installed flush in the board, the front cover of the unit forming the front face of the board.

6.9.3 Separate hinged panels have to be provided in this case for instrumentation and other control equipment. All instrumentation and controls shall be flush mounted on the hinged panels. Reset pushbuttons for protection equipment shall have extension shafts to operate chassis mounted equipment. Protection relays in cases with glass fronts shall be flush mounted. All contactors, fuses, separate protection units not housed in cases, control relays, etc., shall be mounted on a chassis behind the hinged panel. A test push-button for all indication lights shall be provided. Time switches shall not be located amongst switchgear.

6.10 Bolts and Nuts

6.10.1 Only cadmium-plated high tensile steel bolts and hexagonal nuts may be employed at busbar joints and connection points. All nuts shall be provided with spring washers or be of the Nylock type with washers. The largest possible size bolt that will fit into holes in lugs and fixing holes of equipment shall be used in every instance. Bolts shall be sufficient length that at least two but not more than five threads protrude beyond the nut.

6.10.2 Where busbars terminating at the ends of switchboards are intended for future extension, these busbars shall be predrilled to accommodate the extension.

6.10.3 Where pre-fitted space is specified for future equipment, the busbars in the proposed position shall be predrilled and nuts and bolts shall be provided to accommodate the future busbars or cables feeding the equipment.

6.11 Lighting and Other Circuits

6.11.1 The switchgear shall be contained in one place on the switchboard in one or more horizontal tiers. MCB’s shall be flush mounted on a chassis behind a hinged panel with machine punched cut-outs.

6.11.2 All instruments, indicator lights and pushbuttons shall be flush mounted on the hinged panels. Time switches shall either be flushing mounted on the panels or mounted on a chassis behind the panel and shall protrude through a tight fitting cut-out in the panel. Contactors, relays, etc., shall be mounted on the chassis behind the front panel.

6.12 Earthing of Metal Parts

6.12.1 All non-current carrying metal parts of the switchboard including the framework, metal enclosures of equipment, iron cores of contractors and transformers etc., shall be solidly earthed to the earth busbar. All hinged panels shall have a 4mm² flexible copper braid connections which is bolted onto the panel and frame. Screw connections on finished surfaces shall be made with tooth washers.

6.13 Mounting of Equipment

6.13.1 The switchboard shall be designed to adhere to the following spacing constraints:

(a) 75mm Minimum between equipment and the framework, side panels or internal divisions. This space is required on the top, at the bottom and on the sides of equipment.
(b) 75mm Minimum between horizontal rows of equipment, especially rows of moulded case circuit breakers.
(c) Single pole and double pole circuit breaker sizes up to 60A and three pole circuit breaker sizes up to 30A may be installed adjacent to each other.
(d) A minimum distance of 50mm shall be allowed between all circuit breakers, isolators, contactors, etc. with ratings in excess of those of Paragraph (c) above.
(e) Sufficient spacing for all other equipment to allow installation of conductors taking into account the minimum allowable conductor bending radius.
(f) Time switches shall not be located amongst switchgear.

7. BUSBARS

7.1 General

7.1.1 All busbars shall be solid drawing, high conductivity copper busbars and shall comply with the relevant sections of BSS 159 and 1433. Completed busbar installations shall withstand the full test voltage specified in the relevant BS specification.

7.2 Applications

7.2.1 Busbars shall be used in switchboards for the following purposes:

(a) Distribution of main supply (main busbars).
(b) To feed all equipment with a current rating of 200A and more.
(c) Connections to feeder cables larger than 70mm².
(d) Earth bar.
(e) Neutral bar for single phase circuits.

7.3 Rating

7.3.1 The maximum allowable temperature of busbars (including joints) carrying full load current in an ambient temperature as specified shall not exceed 80°C. Unless different ambient temperatures are specified, and ambient temperature of 35°C shall be assumed with a maximum temperature increase of 45°C.

7.3.2 Table 2 may be used as a guide in determining busbar ratings where the distance between the phase busbars is at least the distance of the longer side of the cross section with a minimum spacing of 50mm and at least 150mm from the sheet metal enclosure. It is however essential that the switchboard manufacturer shall make due allowance of the “proximity and skin” effects, the effect of ferrous enclosures, ventilation, etc. for the arrangement used in his switchboard design. Manufacturers shall, where requested, prove that the busbar rating and enclosure design comply with the temperature rise specified above.

7.3.3 In addition to the current rating, busbars shall comply with the following fault level rating of BS 159 where.

A = 7.213I (t) ½

where

A = minimum cross-section (mm²)

I = prospective fault current (kA)

t = maximum time in seconds required for protection equipment to clear the fault (Minimum allowable value for t = 0,2s)

7.3.4 The busbars shall be fixed and supported at sufficient intervals to withstand the mechanical forces that occur during the maximum fault current that can occur. The maximum allowable spacing of busbars supports for fault levels of 20kA and more is 500mm. Where a busbar consists of two or more busbars per phase (laminations), the laminations shall be separated by a minimum distance of the thickness of one lamination The laminations shall be clamped together with copper spacers at intervals not exceeding 450mm in order to equalize the current distribution in the laminations.

7.3.5 The busbar ratings shown on the following page shall be multiplied with the following factors to determine the total current rating per phase:

Derating Factors for Laminated Busbars

WIDTH	NO OF PARALLEL BUSBARS PER PHASE		
	2	3	4
Less than 50mm	1,74	2,30	2,90
Less than 75mm	1,70	2,20	2,45
Less than 100mm	1,66	2,09	2,30
Less than 150mm	1,62	1,97	2,15
More than 150mm	1,57	1,84	2,00

Table 10: Derating factors for laminated busbars

Current Rating of Single Copper Busbars (A)

WIDTH	THICKNESS (mm)							
(mm)	3,15	4,0	5,0	6,3	8,0	10	12,5	16
12,5	146							
16	178	205						
20	215	246	280					
25	259	296	335	383				
31,5	316	360	406	458	522			
40	388	441	492	556	635			
50	471	534	592	668	755	842		
63	570	642	719	805	902	1005	1120	
80	700	786	877	976	1090	1207	1338	
100		950	1050	1170	1301	1440	1582	
125			1262	1396	1555	1706	1885	2090
160				1703	1887	2074	2270	2560
206					2307	2550	2795	3100
250						3010	3210	3630
315							4000	4300

Table 11: Current rating of single copper busbars (A)

7.4 Mounting

7.4.1 All busbars shall be installed horizontally or vertically with the longer side of the cross-section in the vertical plane. Main busbars shall be supported by "DELARON" or "THIOLITE" resin bound synthetic wood panels other suitable dielectric material. These panels shall be firmly bolted to the switchboard frame and shall fit tightly and neatly around the busbars. Busbars may also be mounted on resin insulators. Porcelain insulators are not acceptable. It is essential that busbar supports shall be suitable to withstand the maximum mechanical forces encountered during fault conditions.

7.4.2 Busbars shall be at least 150mm from the nearest equipment. Where busbars protrude through a switchboard panel for incoming or outgoing circuits, the busbars shall be properly insulated and rigidly supported on the inside of the switchboard. This shall preferably be achieved by means of resin bound synthetic wood or similar insulating materials with cut-outs which fit tightly around the busbars. The insulating panel shall be firmly bolted to the frame. Busbars or "droppers" that pass through internal partitions in the switchboard shall be similarly insulated and supported.

7.5 Insulation

7.5.1 All busbars shall be covered with colour heat-shrinkable PVC. The colour shall identify the phase or neutral. Bolted connections between busbar sections shall be covered with a non-hardening compound and then thoroughly covered with PVC tape.

7.5.2 Joints shall be insulated on site after installation on site and after the Engineer has checked the bolts. High tensile steel bolts with washers and spring washers shall be used at joints.

7.6 Busbar Connections

7.6.1 All conductors and cables shall be bolted to busbars using crimped lugs. Cadmium plated steel bolts and nuts, washers and lock washers shall be used.

8. EARTHING

8.1 Neutral Busbars

8.1.1 Neutral busbars in 3 phases, 4 wire supplies shall have a cross-section of at least 60% of the cross-section of the phase busbars.

8.1.2 Where single phase circuits (e.g. lighting and general power circuits) are protected by single phase circuit breakers or fuses, all neutral conductors shall be connected to a separate neutral busbar mounted in a suitable position. The cross-section of the busbar shall be at least 6mm x 25mm and shall be long enough for the lug of each conductor to be bolted separately to the busbar.

8.2 Earth Busbar

8.2.1 An earth busbar shall be installed in a convenient position along the entire length of the switchboard. All earth connections shall be bolted separately to the appropriate busbar. The cross-sectional area of earth busbars shall be calculated according to the formula in IEC 439 with a minimum cross-section of 6mm x 25mm.

8.2.2 In addition the longer side of the earth busbar shall be at least twice the diameter of the largest bolt that will be fitted to the busbar. The earth bar shall be bolted to the frame of the switchboard. Brass earth strips with tapped holes and screws are not acceptable.

8.2.3 Busbars with clamp type terminals that fit over the bar, are acceptable as an alternative to bolted connection.

9. PANEL WIRING

9.1 Power Conductors

9.1.1 Connections between busbars and all equipment in the switchboard shall consist of heavy duty colour PVC insulated stranded annealed copper conductors and/or solid high conductivity copper bars of sample cross-section covered with heat shrinkable PVC.

9.1.2 The colours to be used in all instances shall be red, white and blue for phase connections and black for neutral connections. All circuits with a rating of 200A and more and all connections to cables larger than 70mm², shall consist of busbars only.

9.2 Current ratings

9.2.1 The current rating of all conductors for the internal wiring of switchboards, shall be equal to the capacity of the circuit breaker or fuse which protects the circuit and shall be determined according to the table in the Detail Specification.

Current rating for internal wiring

Nominal cross-section mm²	CONDUCTOR RATING (A)				
	Number of conductors bunched together				
	1	2 – 3	4 – 5	6 – 9	10 and more
1,5	13	12	10	9	8
2,5	17	16	14	12	10
4	22	20	18	16	13
6	29	26	23	20	17
10	40	36	32	28	24
16	55	49	44	38	33
25	74	67	59	52	44
35	93	84	74	65	56
50	119	107	95	83	71
70	148	133	119	104	89
95	178	160	142	124	107

Table 12: Current rating for internal wiring

9.3 Internal Wiring

9.3.1 If the internal ambient temperature of the switchboards is likely to exceed 60°C, SABS approved stranded 600V grade asbestos insulated copper conductors shall be used.

9.3.2 All wiring shall be arranged in horizontal and vertical rows and shall be bound with suitable plastic straps or installed in PVC wiring channels. Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.

9.3.3 Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors. Conductors leaving the harnesses shall be so arranged that they are adjacent to the chassis.

9.3.4 Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points. The loop shall be arranged to produce a twisting motion when the door is opened or closed. A flexible protection sleeve shall be installed over the conductors.

9.3.5 Where wiring channels are used, they shall be installed horizontally and vertically. Under no circumstances may power and control circuit wiring be installed in the same wiring channel. Channels shall not be more than 60% full.

9.3.6 All wiring between different panels within the same switchboard shall be installed in wiring channels.

9.3.7 Grommets shall be installed in each hole in the metalwork through which conductors pass.

9.3.8 All wiring shall be installed away from terminals, clamps or other current carrying parts. Wiring shall also be kept away from exposed metal edges or shall be protected where they cross metal edges.

9.3.9 Conductors may be jointed at equipment terminals or numbered terminal strips only. Ferruled and taped or other connections are not acceptable.

9.3.10 Where screened cables are specified, the screening shall be earthed in the switchboard or control board only unless clearly specified to the contrary. Screened cables entering control boxes through pressed knockouts, shall terminate in compression glands. Conductors shall as far as possible remain inside the screening at terminations. Where conductors have to separate from the screen, the braiding shall be separated and the conductors drawing through the braid without damaging the braiding. The conductors shall then be connected to their respective terminals and the screening smoothed and connected to the earth terminal.

9.3.11 Where neutral connections are looped between the terminals of instruments, it is essential that the two conductor ends be inserted into a common lug or ferrule and are crimped or soldered together in order that the neutral connection is not broken when the conductors are removed from one of the instruments.

9.3.12 Conductors terminating on meters, fuse holders and other equipment with screw terminals, shall be fitted with crimped lugs.

9.4 Fuses

9.4.1 All instrument fuses shall be accessible from the front, located behind the front panels. Where equipment is fed by busbars, the fuse holders shall be bolted directly onto the busbars.

9.4.2 In other cases, conductors from the incoming circuit to the fuse shall be as short as possible. Each fuse shall be separately labelled stating instrument circuit, phase and rating.

9.5 Colour Coding of Wiring

9.5.1 The colour of all conductors for 400V or 230V AC circuits to equipment in the switchboard shall comply with the colour requirements.

9.5.2 Conductors for DC circuits and earth connections shall be grey and green respectively in compliance with SANS 1091 but the conductors for control, alarm, interlocking and measuring circuits, to a consistent colour code.

9.5.3 Each conductor including conductors at terminals shall be marked at both ends by means of durable ferrule type cable markers. Cable markers specially manufactured for this purpose shall be used. Hand-punched PVC or other tapes are not acceptable.

9.5.4 The numbers of all conductors shall appear on switchboard drawings.

9.6 Conductor Support

9.6.1 All cables for incoming or outgoing circuits shall terminate on a gland plate supplied for this purpose and be supported to take the force off the gland. Cable boxes for PILCA cables shall be installed at the bottom of the switchboard.

9.6.2 The conductors of cable shall either be connected directly to the correct equipment if the equipment terminals are situated near the cable gland plate or shall terminate to terminals. Long tails shall be avoided.

9.6.3 Parallel connected cables shall be connected to busbar strips without crossing the individual conductors. Each cable shall be individually identified by means of punched aluminium strips that are tied to the cables.

9.7 Essential and non-essential supplies

9.7.1 "Essential" supply means that in case of power interruption, standby power is either automatically or manually switched to these circuits from a standby power source. Special care shall be taken:
a) to prevent any feedback from the "Essential" to the "Non-essential" supply or vice versa
b) that fan motor starting current does not exceed the capability of the standby power source. If not, special precaution must be taken to limit the motor starting current.

9.7.2 The switchboard shall be divided into electrically separate sections with sheet metal barriers to isolate the "Essential" and "Non-Essential" compartments.

9.7.3 A means shall be provided to isolate the standby and mains power supplies simultaneously. Mechanically interlocked circuit breakers or isolators are preferred. Electrically interlocked circuit breakers or the main switch are acceptable.

9.7.4 Six pole on-load rotary switches rated at 25% in excess of the maximum full load current of the board may be used where the maximum system fault current at the board does not exceed 10kA.

9.7.5 A main switch shall be provided in both the "Essential" and "Non-essential" supply sections of the switchboard which are interlocked with each access door or panel to ensure that the door or panel can only be opened when the main switch for the section of the board is in the OFF position.

9.7.6 Mechanically interlocked circuit breakers or isolators or a 6 pole rotary switch. An additional isolator or circuit breaker shall then be provide as main switch for the "Non-essential" supply section.

9.8 Marshalling Cubicles

9.8.1 When a Programmable Logic Controller (PLC) is used in a switchboard, a separate marshalling cubicle shall be provided. Marshalling cubicles may also be required in other cases where extensive relay logic is used or where interfacing to other equipment may be necessary.

9.8.2 When a PLC is used, the following requirements shall be adhered to:
a) At least one 220V 15 switch socket shall be provided in each PLC cubicle.
b) Spacing of components shall be done in accordance with PLC Manufacturer's specifications. Adequate space for future extensions shall be allowed.
c) Cubicles shall be ventilated to prevent internal temperatures from exceeding 45°C when the ambient temperature is 35°C or less.
d) Cubicle shall have a locking facility.
e) All inputs and outputs shall be wired to terminals (including spare inputs and outputs).
f) Isolated terminals shall be used for all inputs, outputs and power supply terminals.
g) All signal cables shall be run separately from power cables.
h) All analogue cables shall be screened. All screening to be bonded to earth.
i) Surge suppressions shall be provided according to PLC manufacturer's specification.
j) All wiring shall be effect by means of SABS approved stranded 1,5mm² minimum, 600V grade PVC insulated copper conductors.
k) Chassis, back panels and hinged doors shall be properly bonded to the main earth bar.
l) Contactors, relays, etc., shall not be mounted above or below PLC. Clearances all round PLC shall be at least 150mm.
m) All PLC inputs and outputs shall be terminated in logical groupings on a dedicated terminal rail installed vertically at one side of the marshalling cubicle. All panels wiring to other parts of the switchboard shall be terminated on a second terminal rail installed vertically on the opposite side of the marshalling cubicle.

9.8.3 These terminations shall be grouped according to cubicle destination. Internal connections from the PLC to other cubicles shall then be carried out by wiring between these two terminal rails.

10. PAINTING

General

10.1.1 Metal components of the framework, panels and chassis shall be finished with a high quality paint applied according to the best available method. Baked enamel, electro statically applied powder coating or similar proven methods may be used. Care shall be taken to ensure that all edges and corners are properly covered.

10.2 Baked Enamel Finish

10.2.1 Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill scale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting, or acid pickling and washing may be employed for this purpose.

10.2.2 Immediately after cleaning all surfaces shall be covered by and electrolytically applied rust inhibiting, tough, unbroken metal phosphate film and then thoroughly dried.

10.2.3 Within forty eight (48) hours after phosphate, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two (2) coats of high quality baked enamel to SABS 783 type 1.

10.2.4 The minimum paint thickness after baking shall be 0.06mm. The paint shall have a shock resistance of 25kg-cm on 0,9mm soft steel plate and a scratch resistance of 2 000 grams.

10.3 Powder Coated Finish

10.3.1 Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill scale, grease and foreign matter to a continuous metallic finish. Sand or shot blasting, or acid pickling and washing may be employed for this purpose.

10.3.2 The metal parts shall be preheated and then covered by a microstructure paint powder applied electrostatically.

10.3.3 The paint shall be baked and shall harden within 10 minutes at a temperature of 190°C.

10.3.4 The minimum paint thickness after baking shall be 0,05mm and shall have a shock resistance of 25kg-cm on 0,9mm soft steel plate and a scratch resistance of 2 000 grams.

10.4 Colour

10.4.1 The colour shall be electrical orange SANS 1091 on the outside. The inside shall either be the same as the outside or shall be white.

10.4.2 Before the Installation is handed over, the Contractor shall ensure that all painted surfaces are clean and undamaged. Final coats of paint may be applied on site immediately prior to completion.

11. LABELS

11.1 General

11.1.1 Care shall be taken to ensure that all equipment is fully labelled and that accurate descriptions and safety warning notices appear in the languages as requested.

11.1.2 Labels shall be provided:

a) to identify each switchboard and each outgoing circuit; and

b) for all equipment on the inside and outside of the switchboard indicating function and rating. Labels shall correspond to the equipment description on circuit diagrams.

11.1.3 Each piece of equipment shall have a separate label. Combined labels on long label strips, e.g. for single pole circuit breakers are not acceptable. Each label shall be separately removable.

11.2 Material

11.2.1 Engraved plastic or ivory sandwiched strips shall be used throughout. The strips shall bear white lettering on a black background for danger notices.

11.3 Fixing of Labels

11.3.1 Labels shall not be fixed to components or trunking but to doors, panels, chassis or other permanent structures of the switchboard.

11.3.2 Engraved strips shall be secured in such a way as to facilitate a neat alteration of the designation of the labels. The labels shall not be glued to the switchboard. Sufficient fixing points shall be provided to prevent labels from warping.

11.3.3 Labels in slotted holders shall be secured in position to prevent unauthorized removal. The following means of securing labels are acceptable: brass bolts and nuts, self-tapping screws, slotted label holders and pop-rivets.

12. TESTING

12.1 The function of all equipment, control, interlocking and measuring circuits shall be tested to the entire satisfaction of the Engineer. All protection relays and ammeters shall be proven by means of secondary current injection. Test certificates of current transformers, capacitor banks, etc. shall be submitted.

12.2 Polarity tests and primary current injection tests to prove the winding ratios, shall be conducted on all current transformers. The Contractor shall supply all test equipment, test facilities, dummy loads and additional switchgear and wiring at both the factory and on site at his cost. The Engineer shall be notified in writing two weeks before the commencement of tests so that they may witness the tests.

13. DRAWING AND MANUALS

13.1 Drawings for Approval

13.1.1 As soon as possible but not later than four weeks after award of the Contract, the Contractor shall, at his expense submit to the Engineer for approval 3 prints of drawings of:

a) a complete circuit and control diagram of the switchboard and all circuits connected to the switchboard;
b) a dimensional general arrangement drawing showing the position of all equipment on switchboards. The position and method of support of all busbars shall be clearly shown;
c) a list of all labels to be used in the languages as requested;
d) the make and catalogue number of all equipment showing ratings of isolators, contactors, starters, circuit-breakers and the function of all controls, push-buttons, indicator lights, etc.; and
e) all equipment and controls connected to the switchboard, clearly identify the size, function and purpose of each component, including motors, thermostats, micro switches lockout stops etc.

13.1.2 A complete list of drawing symbols shall be provided on each electrical circuit and control drawing.

13.1.3 The approval of drawings shall not relieve the Contractor of his liability to carry out wok in accordance with the terms of the Contract. The Contractor shall not proceed until the drawings have been approved in writing.

13.2 Final Drawings

13.2.1 Upon completion of the Installation, the Contractor shall hand to the Engineer's Representative a set of transparent drawings of the entire installation. These drawings shall show:
a) items (a) to (e) above; and
b) all terminal numbers and the numbers and colours of conductors used for the internal wiring. These drawings shall be up-to-date "as built" drawings containing all modifications.

13.2.2 The Contractor shall mount a copy of each drawing showing the circuit and control diagrams of the complete installation, on a wall in the plant room.

13.2.3 The drawing shall be positioned in an accessible position and shall be mounted in a wooden frame behind plastic. Where necessary, more than one drawing shall be mounted on the wall in cases where the system schematic and the switchboard diagram cannot be shown on the same drawing. The drawings shall be chemically treated to prevent fading occurring.

13.3 Manuals

13.3.1 The Contractor shall at his cost furnish the Engineer with three copies of operating and maintenance manuals for the entire system as well as major component parts of the system, including compressors, heaters, boilers, pumps and all main switchboards and motor control centres and for any other components and switchboards which the Engineer's Representative may deem necessary. These manuals shall contain the following information:
a) A description of the operation of the equipment.
b) A maintenance manual.
c) Descriptive brochures or pamphlets of equipment.
d) A complete equipment list indicating quantities and relevant catalogue numbers.

13.4 Completion

13.4.1 The Contract will be considered incomplete until all tests have been conducted to the satisfaction of the Engineer's Representative and all drawings and manuals have been handed to the Engineer.

14. SWITCHGEAR

14.1 Metal clad air circuit breaker, withdrawal type

14.1.1 The metal clad circuit breaker shall comply with the requirements laid down in BS 4752.

14.1.2 The circuit breaker shall be horizontally withdrawal and shall be a self-contained unit of the dead front type, allowing maintenance and tests to be carried out without having to remove the circuit breaker from the withdrawal mechanism. The unit shall contain the necessary mechanical interlocks to prevent:
(a) Access to "Live" terminals when the breaker is withdrawn.
(b) The withdrawal or insertion of the unit, when the breaker is in the closed position.
(c) Closing of the circuit breaker following an automatic trip conditions without resetting the mechanism.

14.1.3 Adjustable thermal overload releases shall be provided to suit the required current range. In addition, instantaneous magnetic short circuit trips which are adjustable shall be fitted. The tripping devices shall be direct acting. This delay adjustment shall be bypassed with an instantaneous making current release when the circuit breaker is closed to prevent the delay timer from operating when the circuit breaker is closed on a fault.

14.1.4 The tripping time characteristics of the circuit breaker shall be such that good grading can be obtained between the main incoming circuit breaker and the switchgear on the outgoing circuits, under overload and short circuit conditions. High speed current limiting type ACB,s will not be acceptable.

14.1.5 The air circuit breaker shall be of the quick-make and quick-break type with a stored-energy spring assisted operating mechanism provided with:

(a) A trip free mechanical hand operated closing mechanism.

(b) A manually operated mechanical trip mechanism suitably protected to prevent inadvertent tripping.

(c) A positively driven mechanical device to provide ON/OFF/TRIP indication. This indication shall be clearly visible with the circuit breaker in position.

14.1.6 Provision shall exist for the addition, if specified, of a source-side under voltage lockout.

14.1.7 Circuit breakers shall have electrically separate auxiliary contacts as specified. Where none are specified two N/O and two N/C auxiliary contacts shall be provided. Shunt trips and electrical stored energy breakers shall be interlocked to prevent repeated operation of the trips or winding mechanisms when the breaker is in the tripped or closed position.

14.1.8 All non-current carrying metal parts of the circuit breaker shall be solidly interconnected and connected to an earth contact which shall engage with a mating contact or copper plate which is connected to the earth busbar of the switchboard. The arrangement shall be such that the circuit breaker frame is earthed in the test position and before the breaker contacts engage the live fixed contacts.

14.1.9 The fixed cradle shall be of high mechanical strength.

14.1.10 The circuit breaker shall have RACKED-OUT, TEST and ENGAGED positions which shall be clearly marked.

14.1.11 The circuit breaker shall bear a clearly legible rating plate indicating the current rating, breaking capacity and voltage rating.

14.1.12 Extension type operating handles shall be fixed to the circuit breaker on completion of the installation.

14.1.13 The circuit breaker shall be designed to allow the incoming terminals to be at the top or bottom without affecting the operation of the unit.

14.1.14 The circuit breakers shall be departed as necessary to compensate for the following environmental factors:

(a) Maximum ambient air temperature is excess of 40°C or the daily average ambient air temperature in excess of 30°C. This is especially important with regard to the type of enclosure in which the circuit breaker is to be installed.

(b) Height above sea level.

(c) Operational duty cycle and estimating loading.

14.1.15 The complete circuit breaker and its electrical and mechanical constituents and accessories must be a standard product of a single original manufacturer.

14.2 Moulded case circuit breaker

14.2.1 The circuit breaker shall be of the single pole or multi pole free handle, air break type, housed in a moulded phenol or glass polyester case and suitable for panel mounting.

14.2.2 The circuit breaker shall comply with the requirements of SANS 156:1977.

14.2.3 The tripping times of the circuit breakers shall be in accordance with Clause 4.5 of SANS 156:1977.

14.2.4 Circuit breakers used on any one particular service shall be supplied by a single manufacturer.

14.3 On-load, Fault-making switches

14.3.1 On-load, fault-making switches shall be of the triple pole, hand operated, panel mounting, air break type suitable for operation on 380/440V, 50Hz system.

14.3.2 The contacts shall be of silver alloy and the switch mechanism shall be of the quick-make, quick-break type.

14.3.3 The switches shall be capable of opening and closing the full current rating of the switch. The current rating of the switch shall be in excess of the full load current of the circuit which the switch will be required to open. In the case of motor circuits the switch shall be capable of breaking the "locked rotor current" of the motor.

14.3.4 The switches shall further be capable of being closed on to a fault. The switches shall be adequately rated to withstand the maximum fault current that can occur at that point in the circuit for a sufficient time to allow the backup protection (circuit breakers or fuses) to open the circuit.

14.3.5 The switches shall be suitable for mounting behind switchboard panels.

14.3.6 To distinguish the switched from circuit breakers, the operating handle shall have a distinctive colour or other clear indelible indication and shall be clearly labelled "ISOLATOR".

14.4 Rotary Switches

14.4.1 The switches shall be of the cam actuated or wiping air break type with two breaks per pole, the required number of poles and number of functions being provided by the assembly of switch units on a common spindle. Unless specified to the contrary the switches shall be constructed for mounting behind a flush panel, and shall be provided with a suitable faceplate and operating handle.

14.4.2 The contacts shall be of silver alloy and the latching mechanisms shall ensure positive accurate positioning of the handle in relation to faceplate markings. The voltage and current ratings shall be as required by the circuit and control function and the making capacity shall be at least three times the normal current rating.

14.4.3 Special contacts, e.g. late-making, early-breaking, etc., shall be inherent in the design and shall not be improvised by loading or bending contacts.

14.5 Micro gap switches

14.5.1 The switches shall be of the double pole or triple pole (as required) micro gap type, for use on A.C only. Triple pole switches shall be suitable for supply voltages up to 500V and double pole switches for voltages up to 250V.

14.5.2 Heavy brass terminals each with two grub screws shall be provided for incoming and outgoing cables, and the terminals shall be arranged for easy wiring.

14.5.3 The switch shall have solid silver contacts with large contact surfaces capable of carrying, making and breaking its rated current.

14.5.4 The "ON" and "OFF" positions of the switch shall be clearly marked.

14.5.5 The switches shall comply fully with the requirements of SANS 60947-3:2006.

14.6 Combination fuse switch units

14.6.1 The fuse switch shall be of the triple pole type in accordance with BS 2510 or BS 3185 as applicable.

14.6.2 The fuse cartridges shall comply with BS 88, Category of Duty AC 16, 33, 46 or 80 suitable for a 415V 50Hz system. Category of duty shall be matched to the fault level at the point where the fuses are installed.

14.6.3 The fuse switch shall have a hand operated lever and the "ON" and "OFF" positions shall be clearly marked.

14.7 Fuses and fuse holders

14.7.1 High rupturing capacity (HRC) fuses shall comply with the requirements of SANS 10172 or BS 88 with a fusing factor of 1,5.

14.7.2 Fuses which are not mounted integrally with switches shall be mounted on insulated draw-out carriers (holders) which hold the fuses positively after withdrawal. Fuse holder shall comply with SANS 10173.

14.7.3 Each fuse link and holder shall incorporate a visual inspection eye for fault location.

14.7.4 Should live terminals become exposed after the withdrawal of fuses, rigid barriers shall be provided between adjacent sets of terminals to prevent accidental contact during withdrawal or insertion of the fuses.

14.7.5 Control circuits shall be protected by suitably rated fuses. Instrument fuses shall be mounted in close proximity to the relevant instrument. These fuses shall be clearly labelled with engraved "VORENE" or similar strips indicating use, rating and duty (where applicable).

14.7.6 Striker pin fuses shall be equipped with an alarm contact so arranged that the contact closes and remains closed when the striker pin operates.

14.7.7 Fuses shall be so connected that the live terminal is at the top.

14.7.8 Fuse ratings shall be accurate to within 5% of the published value for unused fuses and shall not vary significantly after long periods of service.

14.7.9 Fuses shall be derated for ambient temperatures above 25°C in accordance with the manufacturer's recommendation. If no such recommendation exits, a derating factor of 1% per °C above 25°C shall be applied.

14.7.10 Fuses shall be derated for elevations of more than 1 000m above seal level in accordance with the manufacturer's recommendation. If no such recommendation exists, a derating factor of 1% per 300m above 1 000m above seal level shall be applied.

14.7.11 Time/Current characteristics shall be chosen to suit the application:

(a) Cable protection: The fusing factor shall not exceed 1,5;

(b) Motor circuits: Time-lag characteristic shall be such that the starting currents will not cause deterioration of the fuse

(c) Capacitor circuits: Fuses shall be chosen to withstand a higher than normal full-load current (1,5 times rated capacitor current) to allow for harmonics and shall not deteriorate due to the high transients at switch-on.

(d) Distribution systems: The total operating I^2 to let through by secondary (minor) fuses shall be less than that of primary (major) fuses in any specific branch.

14.7.12 It shall be ensured that the rupturing capacity of a fuse chosen for a specific application shall be adequate both as far as short circuit current and applied voltage are concerned.

14.8 Contactors

14.8.1 Contactors shall be of the open or totally closed, double or triple pole, electromechanical operated air-break type suitable for 220/250V of 380/440V supplies and shall comply with SANS 60947-4-3:1999.

14.8.2 Contactors shall have the following characteristics:

(a) Enclosed coil easily replaceable;

(b) A permanent air gap in the magnetic circuit to prevent sticky operation;

(c) Provision for quick and simple inspection of contacts;

(d) clearly marked main and auxiliary terminals; and

(e) All parts accessible from the front.

14.8.3 Contactors which are not located in switchboards shall be housed in enclosures.

14.8.4 The current rating of the contactor shall be as specified for the circuit with a switching duty in accordance with the IEC Publication 158-1, utilization category AC1 for lighting and power circuits and utilization category AC3 for motor starting.

14.8.5 The mechanical duty of the contactor shall comply with the specified requirements of Class IV of Clause 5.6 of BS775.

14.8.6 In addition to the required current carrying capacity and switching duty of a contactor, the contactor chosen for a particular application shall be rated for the maximum through fault current

allowed by the backup protection devices at the point where the contactor is installed. Careful coordination of short circuit devices shall take place.

14.8.7 All laminations of the magnetic system of the contactor shall be tightly clamped. Noisy contactors will not be accepted.

14.8.8 Non-current carrying metallic parts shall be solidly interconnected and a common screwed earth terminal shall be provided. The contactor shall be earthed to the switchboard earth bar.

14.8.9 Latched contactor shall be provided with a trip coil and a closing coil. The contactor shall remain closed after energizing the closing coil and shall only trip on energizing the trip coil.

14.8.10 Contactor operating coils shall have a voltage rating as required by the control circuitry and shall have the limits of operation and temperature rise as specified in Cause 7.5 and Table IV of IEC Publication 158-1. Latched contactors shall be capable of being tripped at 50% of the rated coil voltage.

14.8.11 Contactors for normal/standby change-over circuits shall be electrically and mechanically interlocked. Contactors shall also be electrically and mechanically interlocked in certain star-delta starters as specified in par 3.2.9 (c).

14.8.12 Contactors with provision for adding auxiliary contacts on site are required. Contactors with permanently fixed auxiliary contacts shall have at least 1 x N/O and 1 x N/C spare auxiliary contacts in addition to contacts specified for control purposes and in addition to contacts required for self-holding operations or economy resistances. Where the number of auxiliary contacts required is greater than the contacts that can be accommodated on the contactor, and auxiliary relay or additional contactor shall be provided to supply the additional contacts.

14.8.13 It shall be possible to replace main contacts without disconnecting wiring.

14.8.14 Auxiliary contacts shall be capable of making, carrying continuously and breaking 6A at 220V A.C., unity power factor.

14.8.15 Auxiliary contact functions required e.g. “lazy” contacts, late-make, late-break, make-before-break, etc. shall be inherent in the contact design. Under no circumstances may these functions be improvised by bending contacts, loading contacts, etc. These functions shall be available in all contactors.

14.8.16 Spare auxiliary contacts shall be wired to numbered terminal strips in the switchboard and shall appear on the switchboard drawings.

14.8.17 All contactors on a specified project shall be from a standard range of one single reputable manufacturer, unless specified to the contrary.

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 5: DIRECT ACTING INDICATING INSTRUMENTS

This section covers direct acting indicating instruments suitable for flush mounting in switchboards or instrument panels.

1. GENERAL REQUIREMENTS

1.1 Instruments shall be suitably rated for the supply voltage and frequency to be applied, which shall be 400/230 V, 50 Hz unless specified to the contrary.
1.2 All the instruments used for a particular application or a specific project shall be from the range of a single reputable supplier and shall have the same face dimensions. The face dimensions shall be square and not less than 96 x 96mm.
1.3 All instruments shall comply with BS 89 and/or IEC 51.
1.4 Instruments shall be screened against magnetic interference and shall have anti static, impact-resistant glass faces.
1.5 Preference will be given to locally manufactured instruments.
1.6 Instruments shall be insulated to achieve a 2 kV insulation resistance to earth.
1.7 All instruments shall be splash proof and dustproof unless more stringent requirements are specified for hazardous locations.
1.8 Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.
1.9 For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified.
1.10 All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with the general specification.
1.11 Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.

2. VOLTMETERS AND VOLTMETER SELECTOR SWITCHES

2.1 Unless specified to the contrary, voltmeters shall be scaled from 0 - 500V in the case of LV applications.
2.2 Voltmeters shall be of the moving iron type with class 1,5 accuracy as specified in IEC 51.
2.3 A zero adjustment screw shall be provided.
2.4 Unless specified to the contrary, a single voltmeter and selector switch shall be provided. The voltmeter switch shall have an "OFF" and three metering positions to indicate readings between neutral and each of the three phases.
2.5 The markings shall be indicated clearly on the face plate of the selector switch and the handle position shall be accurate in relation to the markings on the face plate.
2.6 The selector switch shall be of the cam-actuated or wiping air break type with two breaks per pole.

3. AMMETERS

3.1 Ammeters shall have a moving coil element to indicate instantaneous values.
3.2 Direct reading ammeters up to a maximum rating of 60 A may be used. Current transformer operated ammeters shall be 5 A full scale, calibrated to read actual primary circuit currents. The current transformer ratio shall be indicated on the face plate.
3.3 A zero adjustment screw shall be provided.

3.4 Where combined maximum demand and indicating ammeters are specified, a bimetallic spiral element shall be provided in the same housing to indicate mean value over a 15 minute period.

3.5 The bimetal element shall drive a residual pointer to indicate maximum mean current between resettings. This pointer shall operate on the main scale and shall be of a distinctive colour. The pointer shall be resettable from the face of the meter.

3.6 The bimetal element shall be designed to compensate for limits of ambient temperature between -20°C and 70°C.

3.7 Full load or rated current shall be clearly indicated, preferably with a red line. Unless specified to the contrary, a 100% condensed over scale shall be provided for instantaneous reading instruments and no over scale for combined maximum demand ammeters.

3.8 The intrinsic error, expressed in terms of the fiducial value in accordance with IEC 51, shall be class 1,5 for the instantaneous readings and class 2,5 for the mean maxima.

3.9 Where saturation current transformers are required, these shall form an integral part of the meter. Separate saturation current transformers are unacceptable to the Department.

4. KILOWATT-HOUR METERS

4.1 Unless specified to the contrary, kilowatt-hour meters shall be suitable for operation on 230/250/400 V. 50 Hz systems.

4.2 Meter elements shall be of the inductor disc type and designed to carry the rated current continuously.

4.3 Kilowatt-hour meters shall comply with the relevant parts of BS 37 and BS 5685.

4.4 The integrating period on maximum demand meters shall be 30 minutes unless specified to the contrary.

4.5 The registering mechanism shall be of the cyclometer type, providing a six digit readout with the sixth digit indicating one-tenth of a unit.

4.6 Unless specified to the contrary, the meters shall conform to accuracy Class 1 as specified in IEC 51.

4.7 Kilowatt-hour meters shall be graded and calibrated for the specific application to avoid the application of multiplication factors where possible. Where multiplication factors are unavoidable this shall be clearly indicated in unit form and not as a combination of several factors. Current transformer ratios shall be incorporated in the factor.

4.8 The kilowatt-hour meter shall preferably be provided with a magnetic type of bearing for the disc spindle.

5. CURRENT TRANSFORMERS

5.1 General

Current transformers shall comply with the requirements of BS 3938 and IEC 185 with the exception of the required impulse test level, par.6 below.

5.2 Ratings

5.2.1 Current transformers shall be suitable for the primary currents listed hereunder and their decimal multiples:
10, 12.5, 15, 20, 25, 30, 40, 50, 60 and 75.
The preferred values are:
10,15, 20, 30, 50 and 75.

5.2.2 Current transformers shall have secondary ratings of 1, 2 and 5A, with 5A being preferred.

5.2.3 Current transformers shall have standard outputs of 2, 5, 5, 10, 15 or 30 VA as applicable in terms of the burden of the instruments and interconnecting wiring. The current transformer output shall match the actual instrument burden as closely as possible in order not to introduce unnecessary errors.

6. ACCURACY CLASS

6.1 For metering applications, accuracy classes of 0.1, 0.2, 0.5, 1, 3 or 5 are applicable.where no accuracy class has been specified, the following table may be used as a guide:

Application	Primary Current	Suggested Class
Indicating Instruments	All	5
Metering Applications	Up to 200 A	1
Metering Applications	250 to 600 A	0.5
Metering Applications	800 A and above	0.2

6.2 Where ring type current transformers are specified, the aperture shall not be unnecessarily large as accuracy is thereby reduced.

6.3 The classes for protection are 5P, 10P, 15P, 20P or 30P with 5P and 10P being standard. Turns compensation shall not be employed on protection current transformers for ratios greater than 150/5.

6.4 Class X current transformers shall be used in differential protection systems.

6.5 Manufacturers shall supply the magnetisation curve details and saturation factors for each different transformer ratio.

7. MARKINGS

All current transformers shall come complete with a label on which the following Information is indelibly stamped:

Manufacturer.
Serial No. or Type.
Rated primary and secondary current.
Rated frequency.
Rated output and accuracy class.
Highest system voltage.
Rated insulation level.

8. FAULT CURRENT

Current transformers shall be capable of withstanding the dynamic forces resulting from the maximum through-fault current which may be encountered at the point where they are installed. The short time current rating of current transformers shall be at least equal to that of the associated circuit breaker.

9. IMPULSE LEVEL

Current transformers used in system voltages in excess of 660 V shall withstand an impulse test level of 95 kV. Impulse levels for current transformers used in system voltages up to 660 V shall comply with BS 3938.

10. TESTS

10.1 One protection current transformer of each type used in a contract shall be tested to confirm the estimated characteristics. The following results shall be submitted:
- (a) Magnetisation Curve
- (b) Secondary resistance
- (c) Secondary leakage reactance, if not negligible or if required by the Department.

10.2 The power frequency, secondary to earth and over voltage inter-tum tests in accordance with BS 3938 shall be conducted on all current transformers. Impulse tests shall be conducted on all current transformers intended for use in system voltages in excess of 660 V.

11. INDICATOR LIGHTS

11.1 Indicator lights shall be of neon, incandescent (filament) or LED types. Lamp voltages shall suit the supply or control voltage. Lamps shall be derated for continuous duty by using economy resistors or using input voltages at least 20% lower than the rated lamp voltages.

11.2 Where LED's are used as indicators on main supply voltages a suitable current limiting capacitor and reverse voltage protection diode shall be used. For low AC or DC voltages (+ 24 V) a current limiting resistor will suffice.

11.3 Indicator lights shall comply with BS 1050 where applicable.

11.4 Indicator lights shall be suitable for installation in switchboard panels and doors and shall consist of interchangeable lenses, lamp base, suitably rated and accessible terminals and a chromed screw-on retaining ring or other suitable means to secure the units.

11.5 It shall be possible to replace lamps from the front of the panel without the use of tools.

11.6 Surface mounted indicator lights shall be housed in purpose-made boxes with suitable cover plates.

11.7 Indicator lights shall be equipped with standard removable legend plates. Alternatively, the function shall be clearly indicated by means of labels or by engraving on the lenses.

11.8 All indicator lights for a specific application or switchboard shall be from the range of one manufacturer and shall preferably be of the same size and shall use the same lamp types.

11.9 The following are the preferred colours for indicator lights:
- (a) RED : Abnormal state.
- (b) YELLOW : Attention or caution, (or amber)
- (c) GREEN : Ready for operation.
- (d) WHITE : Circuit live or circuit operating (or clear) normally
- (e) BLUE : Any function not covered by the above colours.

PN 2 STANDARD ELECTRICAL SPECIFICATIONS

SECTION 6: PROJECT SPECIFICATION

1. INTRODUCTION

1.1 The Project Specifications provides an indication of the specific project requirements for the electrical engineering services associated with the fire pump station at Swartkop Air Force Base.

1.2 The Project Specification shall be read in conjunction with all technical specifications, schedules and bills of quantities as referred to and/or bound in this document.

2. SCOPE OF WORK

2.1 The works covers the supply, delivery to site, storage onsite when required and installation and maintenance of all material and equipment required for the electrical installation of the pump station. The installation consists of the following:

(a) Manufacture, Supply and Installation of a Motor Control Centre (MCC) for pump control as well as the supply to small power outlets and lighting.
(b) Associated low voltage cable works for the supply to the MCC, pumps and small power.
(c) Cold and hot commissioning of the motor control centres in conjuction with relevant specialist technical staff.
(d) Earthing of the installation.
(e) Supply and install cable from Jarric Substation.
(f) Supply and install a new circuit breaker for feeder cable protection at Jarric Substation.

3. QUALITY

Adequate and effective quality control standards will be adhered to. The engineer will have the right to inspect equipment at any time.

4. COMMISSIONING AND ACCEPTANCE

The commissioning of specialized equipment must be performed by and approved or accredited person or by the supplier itself.

All procedures as specified by the suppliers will be adhered to at all times. The safety protection procedures must be fully commissioned and approved before any standard tests and commissioning of running equipment is performed.

A competent appointed person will be allocated by the contractor to accompany the Engineer / Client during all inspections / commissioning / tests. The time and dates of such functions will be agreed to by all parties well in advance.

4.1 Acceptance

The “Handing over Certificate” will only be issued by the Engineer upon acceptance of test results. The “Defects Liability Period” commences on the date of the issuing of the “Handing over Certificate”.

4.2 Test Equipment

All equipment used shall have valid calibrated test certificates.

5. AS BUILT DRAWINGS

On completion of the works the Contractor shall provide the Engineer / Client with a complete set of "as built" drawings in the format the Engineer specified. The drawings will indicate all cable positions and exact installation of equipment.

6. OPERATIONS AND MAINTENANCE

The contractor shall provide manuals to the Engineer / Client. The documentation shall provide and include details on items such as:

- Technical details of the equipment
- Operating instructions
- Fault finding procedures
- Maintenance procedures
- Safety procedures

7. DISTRIBUTION BOARD

The main distribution board (DB-main) will form part of the new MCC panel.

8. WIRING OF CIRCUITS

A neutral conductor equal in size as the phase conductors shall be used. The earth wire one size smaller than the phase conductor wire must be installed and shall be insulated, unless otherwise indicated.

Cable lugs shall be used at all cable terminations. The lugs shall be crimped with a hexagonal crimper.

9. CABLES

The contractor shall supply and install all necessary cables with insulated earth wire as specified in the Cable Schedule. All cables shall be SABS approved. The contractor is responsible for the making off and connecting of all cables. All cable routes will be indicated on the "As built" drawings. Concrete cable route marker shall be used as specified. Cable trays, ladders and galvanized conduit shall be used for installing cables inside the new building.

10. LIGHTING

The contractor shall supply and install the luminaires with all fittings and lamps required. A photocell with a bypass switch and contactor circuit.

11. BULK ELECTRICAL SUPPLY

A Medium Voltage (11/22kV) supply will be available on site. The Contractor shall supply and install a new circuit breaker at Jarric Substation as well as a new 120mm² 4 core Cu PVC/SWA/PVC 600/1000V supply cable from Jarric Substation to the new pump station.

12. EXCAVATIONS

See standard specification. The LV cables must be installed at a depth of 800mm. There may be existing services in the area and the contractor must take care when cable trenches are being excavated. It is the contractor's responsibility to trace existing cable routes (by means of electronic detection) and indicate the routes on the marked-up drawings. Any damage to the existing services will be for the contractor's accounts.

13. CONDUIT

In the case where conduits will be used at the pump stations it must be surface mounted galvanised, including all accessories.

14. MOTOR CONTROL CENTRES

The project requirements are:

- The New Motor Control Centre (MCC) shall be floor standing and must be designed for bottom cable entry.
- The MCC must be extendable by bolting on future sections and extending busbars.
- Wireways to be provided on the left of each vertical row of cubicles for cable entry and wiring.
- The new MCC must be designed to a symmetrical fault current rating of 35 kA.
- The new cable trays/conduit will start from underneath the MCC panel.
- All earth wires will be insulated.
- All switches, push buttons, indicator lamps and labels shall be mounted on cubicle doors of the MCC, except for local stop/start stations which will be mounted on pedastals.

15. MOTOR STARTER CUBICLES

Star-Delta Starter

The following will be accommodated in the respective MCC cubicles:

- Motor protection type circuit breaker suitably rated for the motor.
- Suitably rated start-delta contactors and timer.
- Electronic over/underload relay.
- Door mounted "Run", "Stop" and "Trip" indication light.
- Set of power terminals to motor.
- MANUAL / OFF / AUTO / REMOTE selector switch to provide for selection of operation from MCC, local controller or remote control.
- Run-hour meter.
- Control wiring, control equipment and control terminals as required per cubicle.

16. INCOMER CUBICLE

The following will be accommodated in the respective MCC cubicle.

- Main circuit breaker.
- Voltage selector switch and Voltmeter.
- 3 X Current Transformers with Ammeters.
- Power terminals.

The Busbar section must be placed in the top section of the motor control centre to allow easy extension in the future.

17. CONTROL VOLTAGE SECTION

The control voltage for all new works shall be 230V AC. Provide all switchgear etc. necessary.

18. REMOTE START/STOP AND EMERGENCY STOP STATIONS

A remote Emergency stop station shall be mounted at each of the pumps on a suitable floor mounted pedestal.

19. AUTOMATION CONTROL

Motor Control Centre

The Motor Control Centre will have the following basic sections:

Incomer Tier

The Incomer Cubicle will have the main circuit breaker as well as metering and power monitoring devices such as ammeters and voltmeters installed. All power circuits will be monitored for phase failure. The main supply cable to the MCC will be terminated in this cubicle. The fault current on the Incomer will be in the order of 10kA.

Pump Drive Tiers

There will be two pump drive tiers on the MCC. Each tier will have the basic pump drive equipment such as the pump circuit breaker, the soft starter, monitoring devices such as ammeters as well as mode switches. Each mode switch will have options for AUTO / REMOTE / OFF / MANUAL.

Control and marshalling Cubicle

The control and marshalling cubicle will host the control equipment such as relays and timers.

Telemetry Cubicle

The Telemetry Cubicle will make provision for telemetry, but will not be equipped now.

Local Distribution Board

The Local Distribution Board will have all the distribution circuit breakers and earth leakage units for local lighting, local control instruments and small power.

20. CABLE LADDER AND TRAYS

Cable ladder and cable tray must be of heavy duty type and must be installed in the positions indicated on the design drawings. All cable ladders and trays must be constructed from mild steel and must be hot-dipped galvanise to SANS 121.

21. STAND-BY GENERATOR

No new generators are required as Jarric Substation is equipped with adequate standby generator capacity

22. FIRE ALARM / FIRE DETECTION CONTROL

Provision must be made for the pumps to start when a fire detection signal is activated on the boal. However, the pump station will be operated in the manual mode if the fire detection system is not available, or not functional, or not existing.

23. MOTOR CONTROL FUNCTIONALITY

The pumps controlled by the MCC will be controlled as per the following schedule:

SWARTKOP AIR FORCE BASE: FIRE PUMP MOTOR CONTROL CENTRE FUNCTIONALITY						
1	**PANEL DESCRIPTION**		**Fire Pump MCC**			
2	**DRIVE DESCRIPTION**		Incomer Cubicle	Local DB	Pump 1	Pump 2
3	**COMPARTMENT/SUBDIVISION**		Supply	Building	Pump Tiers	
3.1	FEEDING FROM		Generator Panel (Jarric Sub)	Incomer Cubicle	New Mcc	New Mcc
3	FEEDING TO		New MCC	Small Power Circuits	Pump 1	Pump 2
4	**SYSTEM PARAMETERS**			A1	B1	B2
4.1	NOMINAL VOLTAGE	V	400	400	400	400
	Distance from MCC	m	-	-	15	15
4.2	Power Cable	mm²	1 X 120mm² 4-Core Cu + Earth	16mm² Cu, Loops	2X35mm² Cu, 4-Core	2X35mm² Cu, 4-Core
5	**MAIN POWER SUPPLY CIRCUIT COMPONENTS**					
5.1	**CIRCUIT BREAKER**					
5.1.1	RATING	A	225 3ph	60A 1ph	125A 3ph	125A 3ph
5.1.2	RATED SHORT CIRCUIT (min)	kA	15	15kA	15	15
5.2	**CURRENT TRANSFORMERS (METERING)**					
5.2.1	QUANTITY		3			
5.2.2	RATIO		300:5			
5.3	**CONNECTED TO GENERATOR SUPPLY**		Yes			
6	**ADDITIONAL POWER CIRCUITS**			6kA		
6.1	Earth leakage units (no overload protection)			1X 63A 2P		
6.2	Switched socket outlets					
6.3	Lighting circuits			3 X 10A 1P		
6.4	Small power socket outlets (socket mounted on MCC panel)			2 X 20A 1P		
6.5	Photocell + contactor circuit for outdoor lighting			1 X 10A 1P		
6.6	Photocell bypass circuit			1 X 10A 1P		
6.7	Single phase. Welding plug outlet mount on MCC Panel			1 X 32A 1P		
7	**MOTOR DATA**					
7.1	MOTOR NO				1	2
7.2	MOTOR TYPE				Induction	Induction
7.3	RATING (kW)	kW			55	55
7.5	VOLTAGE	V			400	400
7.6	STARTUP CURRENT	A			330.18	330.18
7.7	FULL LOAD CURRENT	A			94.34	94.34
8	**MOTOR PANEL MAIN CIRCUIT COMPONENTS**					
8.1	Droppers from main bus bar			Yes	Yes	Yes
8.2	Protection					
8.2.1	Thermal overload				Yes	Yes
8.2.2	Electronic unit with under- and overcurrent protection					
8.2.3	Under load protection					
8.2.4	Phase failure/rotation protection		Yes			
8.3	Current transformers					
8.3.1	Protection					
8.3.2	Metering (in white phase only)				Yes	Yes
8.4	Motor starter complete					
8.4.1	Soft Start					
8.4.2	Star/Delta				Yes	Yes
8.4.3	Direct-on-line (DOL)					
8.4.4	Variable Speed					

9	**DOOR MOUNTED EQUIPMENT**					
9.1	Voltmeter with selector switch for R-Y, R-B, Y-B, R-N, Y-N, B-N	-	Yes			
9.2	Amp meter (one for each phase)	-	Yes			
9.3	Selector switches	-				
9.3.1	4-Position: Local/Remote/Off/ Auto				Yes	Yes
9.3.2	3-Position: Local/Remote/Auto					
9.3.3	2-Position: Duty/Standby					
9.3.4	2-Position: Manual/Auto					
9.3.5	2-Position: Local/Remote					
9.3.6	3-Position: Manual/Remote/Local (remote = telemetry; auto = local field instruments)					
9.4	Push buttons (local – at MCC)	-				
9.4.1	Green for Start				Yes	Yes
9.4.2	Red for Stop				Yes	Yes
9.4.3	Yellow for trip reset				Yes	Yes
9.4.4	Black for lamp test		Yes		Yes	Yes
9.5	Handle and extension shaft for door operated isolator	-	Yes		Yes	Yes
9.6	Indicating lights	-				
9.6.1	Green for run				Yes	Yes
9.6.2	Red for stop				Yes	Yes
9.6.3	Yellow for trip				Yes	Yes
9.7	Non-resettable trip counter	-			Yes	Yes
9.8	Running hour meter	-			Yes	Yes
10	**CONTROL ELEMENTS / COMPONENTS**					
10.1	Timer control – 24 hour with 15 minute selectable intervals					
10.2	Alternate pump duties (Flip-Flop)				Yes	Yes
10.3	Motor heater control				Yes	Yes
10.4	Motor thermistor control				Yes	Yes
10.5	Automatic Switchover relay to bring in standby pump if duty pump fails				Yes	Yes
10.6	On delay timer– adjustable up to 2 minutes in 10 second intervals – to prevent simultaneous start up				Yes	Yes
10.7	No-flow switch startup lock-out timer				Yes	Yes
10.8	Flow meter threshold control (Switch on above a certain flow - 4-20mA					
10.9	Control valve interface				Yes	Yes
10.10	High pressure switch control				Yes	Yes
10.11	Float switch control					
10.12	Telemetry control				Yes	Yes
10.13	Fire Alarm control				Yes	Yes
11	**REMOTE CONTROL STATION**					
11.1	Push buttons (remote at motor)	-				
11.1.1	Green for Start					
11.1.2	Red for Emergency Stop (Twist to release – Mushroom type)				Yes	Yes

C3.3 PARTICULAR SPECIFICATIONS

SECTION DWK: DAYWORKS

This part of the Project Specifications deals with the provision for Dayworks in the Schedule of Quantities. Rates for Dayworks shall be entered in the *DAYWORKS* schedule of the Schedule of Quantities in accordance with the following specifications.

DWK 1 SCOPE

According to clause 6.5 of the General Conditions of Contract for construction works (GCC) 2010 edition, certain work may be carried out using rates tendered in the daywork schedule. A schedule of personnel, plant and equipment which may be necessary to perform work on a daywork basis is included in the schedule of quantities. The quantities used in the schedule are for tender evaluation purposes only and the use or not of these items shall not constitute a variation in terms of Clause 6.4 of the General Conditions of Contract 2010 edition.

No work will be paid for as Dayworks without the written instruction or approval of the Engineer.

DWK 2 TYPE OF WORK

The Engineer may order daywork in certain cases where it is necessary to vary or to extend the works due to new or unforeseen circumstances to such an extent that the tendered rates for specific items of work are no longer applicable, or where no suitable combination of tendered rates can be used to pay for such work.

As a general rule, applicable rates for additional work items will be agreed between the Contractor and the Engineer. Dayworks will only be used in exceptional circumstances.

DWK 3 MATERIALS

Materials for use in works carried out under Daywork shall be purchased by the Contractor who shall also arrange for delivery to site, and shall be responsible for any other requirements associated with specific materials. A Provisional Sum has been allowed in the DAYWORKS schedule for Daywork materials. The Contractor shall enter a tendered percentage in the schedule to cover his handling costs and profit, as per other provisional and prime cost sums in this Contract.

Materials shall be paid for using the method described in the Pricing Data. No contract price adjustment will be applicable to materials.

The Contractor shall submit proof of ownership for any materials used in Dayworks with his dayworks claim to the Engineer. Further, if specific materials are required for Dayworks, quotations will be called for as per Clause 6.5.2 of the General Conditions of Contract 2010 edition.

DWK 4 CONSTRUCTION PLANT HIRE

Where daywork is ordered, the tendered rates for plant hire in the DAYWORKS schedule shall be used in calculating the payment due for any plant required to execute the daywork. If no rate is included in the schedule for a particular piece of equipment, and where no other rate or combination of rates would provide suitable compensation, then the daywork method of payment described in Clause 6.5.1 of the General Conditions of Contract 2010 edition will be used.

The tendered rates for each item of constructional plant shall include for all operating costs associated with the said item of plant. Such costs are deemed to include fuel, re-fuelling costs, lubrication and routine servicing / maintenance, breakdowns and spares, all overhead costs, site management costs and administration costs. The

tendered rates shall also include the plant operator and the general supervision of the plant while it is engaged in the dayworks.

DWK 5 SALARIES AND WAGES OF WORKMEN

The salaries and wages of workmen executing daywork shall be paid for using the tendered rates in the DAYWORKS schedule. The tendered rates shall include for all costs associated with the employment of personnel, including salaries, wages, allowances, workmen's compensation, medical aid and pension contributions, government levies and taxes, training costs and any costs associated with living on the site. The tendered rates shall also include for the transportation of the workmen to the site of the dayworks.

All overhead costs, administration costs, site management costs and the Contractor's profit are deemed to be covered by the Dayworks rates and no additions or mark ups will be made to the tendered rates.

The tendered rates shall also include any hand tools normally associated with the workmen's job description e.g. picks, shovels, hammers, saws, spirit levels, etc. The tendered rate for labourers shall also include for the casual supervision by a gang boss or foreman. Only when specifically called for by the Engineer, will payment be made for the use of a gang boss or foreman supervising on a continuous basis.

DWK 6 MEASUREMENT AND PAYMENT

The following payment items shall apply:

ITEM		UNIT
DWK 6.1	Labourers:	
	(a) Unskilled	hr
	(b) Semi-skilled	hr
	(c) Skilled	hr
DWK 6.2	.....Foreman.....	hr
DWK 6.3	.....Tipper trucks:	
	(a) a) Capacity 6m³ (small)	hr
	(b) b) Capacity 10m³ (medium)	hr
DWK 6.4	.....Loader (0.5 m³ bucket)	hr
DWK 6.5	.....Excavator (CAT 350 or similar)	hr
DWK 6.6	.....Grader (CAT 140G or similar)	hr
DWK 6.7	.....Vibratory roller (10 ton)	hr
DWK 6.8	.....Grid Roller	hr
DWK 6.9	.....Pedestrian roller (Bomag BW 90 or similar)	hr
DWK 6.10	...Compactors:	
	(a) Wacker	hr
	(b) Plate Compactor	hr
DWK 6.11	...Loader (CAT 416D or similar)	hr

DWK 6.12 ...Watertruck:
(a) Capacity 6,000 litres (small)... .... hr
(b) Capacity 9,000 litres (medium) .... hr
(c) Capacity 15,000 litres (large) . ... hr

DWK 6.13 ...Dozer (D6 or similar) .... hr

DWK 6.14 ...Flatbed truck:
(a) Capacity 3 ton (small)..... .... km
(b) Capacity 5 ton (medium)..... .... km

DWK 6.15 ...LDV (1800 cc minimum) .... km

DWK 6.16 ...Walk Behind – Saw .... hr

DWK 6.17 ...Compressors (Potable Diesiel Compressor):
(a) Small..... .... hr
(b) Medium .... hr
(c) Large..... .... hr

DWK 6.18 ...Breaker:
(a) Air Breaker... .... hr

DWK 6.19 ...Portable water pumps:
(a) Small..... .... hr
(b) Medium .... hr

DWK 6.20 ...Materials under dayworks:

a. ...Materials acquired under dayworks materials..... .....
.... PC Sum

b. ...Handling cost and profit in respect of Item DWK 6.16 (a) ..
.... Percentage (%)

The following principles shall apply to the measurement and payment of Dayworks:

The unit of measurement for plant shall be the number of vibroclock hours worked and each item of plant shall be fitted with a vibroclock, the cost of which shall be included in the rates. Excessive non-productive time when the engine is idling will not be paid for. Where there is ambiguity between the flywheel horsepower and mass of the machine, the flywheel horsepower shall govern the measurement category. Where width and mass are specified, mass shall govern the measurement category.

The Contractor's attention is drawn to the requirements of Sub-clauses 6.5.3 and 6.5.4 of the General Condition of Contract 2010 edition with regard to the submission of Dayworks claims.

PP ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)

Project	Dolomite Risk Management Strategy: DOD: SAAF: Swartkop Air Force Base: Replacement and Upgrading of Civil Engineering Services and Sinkhole Rehabilitation: Completion Contract
Consulting engineers	Endecon Ubuntu (Pty) Ltd.
Contractor	To be appointed
Scope of work	• Rehabilitation of the Swartkop Air Force Base wet services and reduction of dolomitic risks. • The work area is located on dolomitic strata (dolomite/chert in various degrees of weathering) of the Chuniespoort Group, Transvaal Sequence. Certain areas are overlaid by younger Karoo rocks of variable depth. Typically, the residual dolomite is covered by transported, colluvial or wind-blown, aeolian sands, which often have a collapse fabric, which has proven in the past to be problematic. • Numerous sinkholes and dolines were recorded in the past and previous drilling operations showed that cavities of different sizes do exist in the work area at variable depths.

PP 1 MANAGEMENT ACTIONS REQUIRED

Refer to Table 1 for localised impacts and Table 2 for cumulative impacts.

Table 1

Localised Impacts

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
TIME PERIOD: PLANNING AND DESIGN		
1. Integrity of water pipelines, V-drains and related equipment and related equipment	1. Design water pipelines, V-drains and related equipment and related equipment in accordance with appropriate international codes and standards for material, performance, pressure testing and application specifications. 2. Design water pipelines, V-drains and related equipment and related equipment in accordance with appropriate safety risk classification. • Appoint a government approved independent inspection authority to verify the acceptability of construction materials and activities.	Principal Construction Contractor
2. Localities of pipeline sections and components	• Minimum vegetation must be removed for the installation of the pipeline sections system. • The owner of the land where the components are to be installed must give written approval. • Right-of-way agreements must be obtained from the Air Force Base Commander.	Principal Construction Contractor
3. Locality of pipeline sections	• Minimum vegetation must be removed for the installation of the pipeline sections. • The owner of the land where pipelines are to be installed must give written approval. • Right-of-way agreements must be obtained from the Air Force Base Commander.	Principal Construction Contractor
4. Environmental control officer (ECO)	• An environmental control officer must be appointed to do regular environmental audits on the project. • The ECO must comply with the following requirements: ❑ He/she must be independent from the applicant. ❑ He/she must have at least 5 years' experience as environmental assessment practitioner. ❑ He/she must be registered with the SA Council for Natural Scientific Professions (SACNASP).	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
5. Risk of dolomitic substrata	• Construction work must be executed in accordance with the information contained in the geotechnical study report. • All precautions must be taken to avoid injuries caused by dolomitic sink holes. • Storm water on site must be managed in such a way that the creation of new sinkholes or the erosion of existing sinkholes must be prevented.	Principal Construction Contractor
TIME PERIOD: CONSTRUCTION		
1. Occupational safety and health of construction workers	• All the requirements of the Occupational Health and Safety Act (Act No 85 of 1993) must be met. • All the requirements of the Construction Regulations of 7 February 2014 must be met. • The contractor must submit a Health and Safety Plan to Independent Development Trust for approval prior to site establishment. • Daily safety toolbox talks must be held with all construction workers and must be recorded in writing. • All construction workers and visitors on site must wear the prescribed personal protective clothing and equipment. • All daily inspection registers must be completed as required by the Construction Regulations.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
2. Possible damage to utility services	• Right-of-way agreements must be obtained from provincial and municipal authorities, if necessary. • The construction contractor must locate all possible utility services prior to excavation work. • Written approval for rights-of-way must be obtained from all utility service providers, including Transnet, Rand Water, Telkom, Eskom Transmission, Eskom Distribution and the local municipality. • The owners of utility services must be notified before excavation is done and requested to send a supervisor to the site. • If utility services are damaged, the owner of the service must be notified immediately and the service must be repaired to the satisfaction of the owner.	Principal Construction Contractor
3. Construction noise	• Noise caused by construction activities must be minimised. • Construction activities must be limited to daylight hours, between 06:00 and 18:00. • Adjacent Base Commanders and inhabitants must be notified if excessive noise will be produced.	Principal Construction Contractor
4. Airborne emissions	• All construction vehicles must be maintained in good order to ensure that minimum exhaust smoke and gases are emitted. • No open fires must be allowed on site. • No waste may be burnt on site. • Dust on dirt roads must be suppressed by means of water spraying.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
5. Offloading of heavy equipment and machinery	• No bystanders must be allowed nearby. • Traffic must be controlled to avoid disruption. • If necessary, the Base Commander must be requested for assistance. • Roads and access ways must never be blocked. • Material and equipment must be stored in a safe place with proper fencing around it and a lockable gate with proper security access control.	Principal Construction Contractor
6. Removal and storage of topsoil	• Where appropriate, the top 150 mm layer of soil contains valuable plant nutrients that must be preserved. • Removed topsoil must be stored separately and must be replaced last, after bedding, padding and backfilling. • Topsoil must be stored in such a manner that wind erosion would be minimised. • Topsoil must be stored in such a manner that water erosion would be minimised.	Principal Construction Contractor
7. Security of adjacent facilities and areas	• Construction workers may not wander off site without permission. • The construction contractor must keep a Complaints Register on site in which all complaints from adjacent Base Commanders and inhabitants must be recorded with an indication of how and when each complaint was resolve. • Restricted areas may never be accessed without written approval from the Base Commander. • No construction worker camp may be established on site. • Construction workers must be made aware of the fact that access to restricted areas without permission is forbidden.	Principal Construction Contractor
8. Removal of fences and gates	• Where fences and gates have to be removed for access to the construction area, approval must be obtained from the Base Commander. • All removed fences and gates must be replaced in the same or better condition.	Principal Construction Contractor
9. Damage to artificial water drainage systems	• Drainage lines, pipes and canals installed to control storm water flow, may not be damaged. • If damage occurred, the owner of the system must be notified and the system must be repaired immediately to the satisfaction of the owner.	Principal Construction Contractor
10. Production of construction waste and spoil	• Construction waste such as soil, rocks, stones and waste vegetation must be stored separately and neatly where it can cause no harm to people and livestock. • Waste vegetation may not be burnt on site. • Waste trees such as Blue Gum, Black Wattle and Pine may be cut up and donated to local communities as firewood. • Waste soil must be used as backfill material. • Residual waste rocks and stones must be levelled in accordance with the requirements of the Base Commander and must blend into the natural environment. • NO FOD may be left on site and must be handled in accordance with the requirements of the Base Commander.	Principal Construction Contractor
11. Xenobiotic contamination by fuel, lubricants and chemical substances such as paint and solvents	• Spillages of xenobiotic materials on soil and in water must be avoided. • If soil is contaminated, the spilled material must immediately be excavated immediately to a depth of 300 mm, segregated in a plastic container and taken to the Holfontein hazardous waste disposal site for further handling. • Spilled materials may not be treated as general waste. • No vehicles may be serviced on site. • When construction vehicles are parked on site, drip trays must be placed under them to catch leaking oil or diesel. • Xenobiotic substances may never be spilled into a natural water source. In the unlikely event of it happening, the Department of Water Affairs and Forestry must be notified immediately.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
12. Construction worker welfare facilities	• The construction camp facilities must comply with the Occupational Health and Safety Act. • Males and females may not be accommodated in the same camp. • Construction workers must be educated about the serious risks of HIV/AIDS and workers must have access to condoms. • The conditions in the construction camp must be discussed with all workers during every safety toolbox talk and must be recorded in writing. • The Camp Supervisor must complete a daily inspection register in which the following points are checked: ❑ Food handling facilities. ❑ Toilets. ❑ Sleeping quarters. ❑ Washing facilities, with hot and cold water. ❑ No open fires. ❑ Mixing of males and females. ❑ Storage of dangerous materials. ❑ Electrical connections. ❑ Facilities to dry washed clothes. ❑ Abuse of alcohol and other intoxicating substances.	Principal Construction Contractor
13. Visual effects	• Equipment and materials must be stored in a demarcated area, as far as possible out of sight for members of the public. • Excavated soil, rock and stones must be stored in low heaps to minimise the visual impact. • All complaints from interested and affected parties must be recorded in the Complaints Register.	Principal Construction Contractor
14. Rehabilitation of the construction area and spoil management	• The construction area must be rehabilitated after completion of the installation of water pipelines, V-drains and related equipment and related equipment and other equipment. • The Base Commander must sign off the rehabilitation work on his/her property as acceptable. • The ECO must sign off the rehabilitation work as acceptable, in accordance with the conditions of the EMPr.	Principal Construction Contractor
15. Temporary job creation	• The construction contractor must endeavour, as far as reasonably practicable, to appoint local labourers for the construction work. • Local labourers must be trained in the following aspects: ❑ How to do the work. ❑ Safety and health in the workplace. ❑ Environmental protection on the site.	Principal Construction Contractor
16. Soil erosion	• Soil must be stacked as low as possible to minimise erosion caused by wind. • Adequate water drainage must be provided at the construction site to prevent erosion of soil caused by uncontrolled water flow, especially during rainy periods. Dolomitic risks must be taken into account. • Silting of natural water sources must be prevented.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
17. Safety of nearby communities	• All open construction trenches and excavated holes outside the air force base must be barricaded to prevent members of the public and livestock from falling into it. • Construction workers may not wander off from the construction site without permission. • All construction workers must be made aware of the security requirements of private people.	Principal Construction Contractor
18. Crossing of tar roads	• Tar roads must be crossed in accordance with the requirements of the national, provincial and municipal roads authorities. • Damage to tar road surfaces, caused by construction vehicles, must be prevented. • If caterpillar track machines have to cross tar roads, used lorry tyres must be placed under the tracks to protect the tar surface. • Proper traffic control measures must be exercised to prevent traffic disruption and road accidents, such as road warning signs, flag jockeys and barricading.	Principal Construction Contractor
19. Safety of pedestrians near the construction site	• Pedestrian walkways must never be blocked. • Adequate and safe bypasses must be provided for pedestrians, where necessary. • All open holes and trenches must be barricaded to prevent pedestrians from falling into it.	Principal Construction Contractor
20. Allocation of construction contracts to local contractors	• This is a positive impact. • The construction contractor must endeavour to allocate subcontracts to local contractors, as far as reasonably practicable. • The appointment of local subcontractors must be done with due cognisance of the requirements for safety and reliability of the water pipelines and related equipment.	Principal Construction Contractor
21. Work area restriction	• Dangerous areas at the construction site must be barricaded to prevent people from entering these areas. • Where sensitive areas have been identified such as wetlands or endangered habitat, these areas must be demarcated and barricaded to prevent access by construction workers.	Principal Construction Contractor
22. Training of workers	• All construction workers must be trained in the following: ❑ How to do their work. ❑ Safety and health at the workplace. ❑ Environmental protection. • Proper records must be kept of such training. • Regular Planned Task Observations must be done on site. • Environmental toolbox talks must be held at least weekly with workers.	Principal Construction Contractor
23. Interruption of water supply to users	• The supply of water to users may not be interrupted. • Existing water pipelines and related equipment must not be damaged by the construction activities.	Principal Construction Contractor
24. Disruption of traffic flow	• The normal flow of traffic may not be disrupted by construction activities. • If necessary, the traffic departments of Secunda, Balfour or Sasolburg must be requested to assist with the management of traffic. • Access roads may never be blocked.	Principal Construction Contractor
25. Safety of bystanders	• The construction activities will have spectator value for members of the public and job seekers. • Bystanders must be controlled to stay away from the construction activities.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
26. Removal of vegetation	• Minimum vegetation must be removed for construction purposes. • Waste vegetation may not be burnt on site. • Waste vegetation must be taken to a registered waste disposal site for disposal. • Waste trees such as Blue Gum, Black Wattle and Pine, may be cut up and provided to members of local communities for firewood. • Alien vegetation must be removed manually and not through the use of chemical herbicides. • Alien vegetation growth at water pipelines, V-drains and related equipment sections and related equipment must be controlled for at least 12 months after completion of construction.	Principal Construction Contractor
27. Obstruction of access roads	• Access roads to dwellings, farms, amenities, facilities and public places may not be blocked. • If an access road has to be closed temporarily, an alternative safe and convenient route must be provided. • All complaints from road users must be recorded in the Complaints Register.	Principal Construction Contractor
28. Sand borrowing	• Sand must be procured from commercial sand suppliers or excavated soil must be screened to comply the particle size specification. • Sand borrow pits may not be created.	Principal Construction Contractor
29. Water use	• If water for hydrostatic testing of water pipelines and related equipment and related equipment are to be abstracted from a natural source, the following written approvals are required: ❑ The Base Commander on whose property the water source is situated. ❑ The Department of Water Affairs and Forestry. • It is recommended that water be purchased form the nearest local municipality. • Water used for hydrostatic testing (waste water) may only be discharged into a natural water source after laboratory analysis has confirmed that the quality complies with the discharge specifications of the Department of Water Affairs and Forestry.	Principal Construction Contractor
30. Requirements of Local Municipality	• All the bylaws of the City Of Tshwane must be obeyed.	Principal Construction Contractor
31. Crossing of natural watercourses (rivers, spruite and wetlands)	• An integrated water use license must be obtained from the Department of Water Affairs and Forestry for the crossing of rivers, spruite and wetlands, in accordance with Sections 21 I and (i) of the National water Act (Act 36 of 1998). • All the conditions of the water use license must be met during all phases of the project.	Principal Construction Contractor
32. Consent from Base Commander	• Private or restricted land may never be accessed without written consent from the Base Commander. • The applicant must appoint an independent land valuer to conduct valuations on all affected land, in terms of land use, crop value and compensation. • The applicant must register servitude against the title deed of each affected property.	Principal Construction Contractor
33. Non-disruption of air force base activities	• Construction on the air force base land may start only after the Base Commander has given written approval. • Water pipelines, V-drains and related equipment and related equipment must be buried deep enough to allow the base to continue with normal activities. • All requirements of the Base Commander must be met.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
34. Land use	• The construction area must be kept as small as reasonably practicable, to minimise the environmental footprint and temporary sterilisation of land. • The construction and operation of water pipelines, V-drains and related equipment and related equipment must not necessitate the rezoning of land. • The pipeline sections, valve boxes, telemetry equipment and any other related equipment must be located in an area where land use would not be affected. • The contours of the land must be preserved. • Water drainage furrows must not be altered or damaged in any way, unless as prescribed by the consulting engineers.	Principal Construction Contractor
35. Heritage artefacts	• Archaeological artefacts discovered during construction must be labelled and preserved. • If the presence of artefacts is noted during excavation of the trench, excavation work must be stopped immediately and the SA Heritage Resources Agency (SAHRA) must be notified. • All further excavation work must be done under direct supervision of a qualified archaeologist or palaeontologist. • Artefacts must never be destroyed or damaged.	Principal Construction Contractor
36. Heritage sites	• Water pipelines, V-drains and related equipment and related equipment' route must avoid all gravesites. • No heritage object may be removed or altered to make way for the liquid gas pipeline and related equipment. • Water pipelines, V-drains and related equipment and related equipment' route must avoid all heritage objects and sites.	Principal Construction Contractor
37. Cathodic corrosion protection system	• No damage must be done to the cathodic corrosion protection system of steel water pipelines and related equipment.	Principal Construction Contractor
38. Excavation work where the water table is high	• Excavations must take place under constant supervision. • Water that seeps into the trench must be pumped out constantly. • The health and safety plan of the contractor must make provision for this impact.	Principal Construction Contractor
39. Prevention of veld fires	• No open fires may be allowed on site. • Workers must be trained to prevent veld fires.	Principal Construction Contractor
40. Cement mixing	• Cement may only be mixed on an impermeable layer. • No residual cement or concrete may be left on site after completion of the work. • Residual cement or concrete must be disposed of a at a registered general waste landfill site.	Principal Construction Contractor
41. Waste management	• No FOD must be left unmanaged on the base. • Waste bins with lids must be available at all work places. • No littering is allowed on site and the surrounding environment. • No waste may be burned or buried on site. • Workers must be educated about waste management as contained in this EMPr. • General waste must be removed from site at least weekly and disposed of at a registered general landfill site. • Hazardous waste must be removed from site at completion of the work and disposed of at a registered hazardous landfill site such as Holfontein. • Waste generated on site must be segregated in plastic, glass and metal. • All efforts must be made to recycle waste.	Principal Construction Contractor
42. Method statements	• The contractor must make available method statements for all activities performed on site.	Principal Construction Contractor
43. Risk assessment	• The contractor shall conduct an environmental risk assessment prior to the pipeline sections work.	Principal Construction Contractor

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
43. On-site emergency plan	• The contractor must compile an on-site emergency response plan for the work. • All workers on site must be trained in the implementation and use of the emergency plan.	Principal Construction Contractor
44. Alien vegetation growth (weeds)	• Any alien vegetation growth at the work area must be eradicated manually to prevent proliferation. • Alien vegetation must be eradicated by the contractor for a period of one year after completion of the work.	Principal Construction Contractor
TIME PERIOD: REHABILITATION		
1. The construction area must be rehabilitated.	• Rehabilitation must take place in accordance with all the requirements of the various authorities. • Written approval for all rehabilitation work must be obtained in writing from the Base Commander. • Rehabilitation must take place in accordance with all the conditions of this EMPr.	Principal Construction Contractor
2. Management of construction spoil	• Excavated soil must be used as backfill for the trench, as far as possible. • Residual soil must be landscaped in such a way that it blends in with the natural environment. • Rocks and stones must be levelled and spread to blend in with the natural environment. • Residual soil must be used to create berms to control storm water flow and to prevent soil erosion. • Soil must temporarily be stacked during construction in such a way that wind erosion will be minimised i.e. keep the stack height as low as possible.	Principal Construction Contractor
TIME PERIOD: COMMISSIONING		
1. Residual water in water pipelines, V-drains and related equipment, if any	• Residual water must be sampled and analysed against the quality standards of DWAF laid down for discharges into the natural environment. • Only if the water quality meets those standards, may it be discharged into the environment. • A SANAS accredited laboratory must perform analysis.	Principal Construction Contractor
2. Spillage of fuel into surface water sources	• The spillage of liquid hydrocarbon fuel and oil on soil must be prevented at all costs.	Principal Construction Contractor
3. Spillage of fuel into underground water sources	• The spillage of liquid hydrocarbon fuel and oil in natural water courses must be prevented at all costs.	Principal Construction Contractor
4. Spillage of fuel and the creation of a fire	• Spilled or leaked fuel such as petrol and diesel create a serious fire risk. • The contractor must compile an Emergency Management Plan that must makes provision for such emergencies. • No fires may be allowed on the base.	Principal Construction Contractor

Table 2

Cumulative Impacts

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Responsible Person
TIME PERIOD: DESIGN AND PLANNING		
None identified	-	-
TIME PERIOD: CONSTRUCTION		
1. Atmospheric emissions	• All construction vehicles must be maintained in good order to ensure that minimum exhaust smoke and gases are emitted. • No open fires must be allowed on site. • No waste may be burnt on site. • Dust on dirt roads must be suppressed by means of water spraying.	Principal Construction Contractor
2. Storm water management	• The risk of dolomitic substrata must be taken into consideration. • The geotechnical study report must be consulted. • Storm water run-off from the construction site must be controlled at all times, especially during heavy rainfall periods. • Where slopes exist at the site after construction, berms must be built to channel storm water in the right direction so that soil erosion can be prevented. • Rocks and stones from construction spoil can be used as barriers to retard and redirect storm water flow. • All storm water control measures on base land must be approved in writing by the Base Commander before it may be implemented.	Principal Construction Contractor
3. Traffic flow	• The normal flow of traffic may not be disrupted by construction activities. • If necessary, the base commander or the traffic department of City of Tshwane must be requested to assist with the management of traffic. • Access roads may never be blocked.	Principal Construction Contractor
TIME PERIOD: REHABILITATION		
1. The construction area must be rehabilitated	• Rehabilitation must take place in accordance with all the requirements of the various authorities. • Written approval for all rehabilitation work must be obtained in writing from the Base Commander. • Rehabilitation must take place in accordance with all the conditions of any environmental authorisation.	Principal Construction Contractor
2. Management of construction spoil	• Other, unrelated construction activities may be ongoing in the area where the liquid fuel gas pipeline and related equipment are installed. • The construction impact would be compounded. • Excavated soil must be used as backfill for trenches, as far as possible and as prescribed by the consulting engineers. • Residual soil must be landscaped in such a way that it blends in with the natural environment. • Rocks and stones must be levelled and spread to blend in with the natural environment. • Residual soil must be used to create berms to control storm water flow and to prevent soil erosion.	Principal Construction Contractor

	• Soil must temporarily be stacked during construction in such a way that wind erosion will be minimised i.e. keep the stack height as low as possible.	
TIME PERIOD: COMMISSIONING		
1. Residual water in water pipelines and related equipment and related equipment after hydrostatic pressure-testing, if any	• Residual water must be sampled and analysed against the quality standards of DWAF laid down for discharges into the natural environment. • Only if the water quality meets those standards, may it be discharged into the environment. • A SANAS accredited laboratory must perform analysis.	Principal Construction Contractor
2. Spillage of fuel into surface water sources	• The spillage of liquid hydrocarbon fuel and oil must be prevented at all costs.	Principal Construction Contractor
3. Spillage of fuel into underground water sources	• The spillage of liquid hydrocarbon fuel and oil must be prevented at all costs.	Principal Construction Contractor
4. Spillage of fuel and the creation of a fire	• Spilled or leaked fuel such as petrol and diesel create a serious fire risk. • The contractor must compile an Emergency Management Plan that must makes provision for such emergencies. • No fires may be allowed on the base.	Principal Construction Contractor

PP 2 ENVIRONMENTAL AUDIT PROTOCOL

The independent Environmental Control Officer shall use the following environmental audit protocol:

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
1. Integrity of water pipelines, V-drains and related equipment	• Design water pipelines, V-drains and related equipment and related equipment in accordance with appropriate international codes and standards. • Design water pipelines, V-drains and related equipment and related equipment in accordance with appropriate international codes for safety risk. • Appoint a government approved independent inspection authority to verify the acceptability of construction materials and activities.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
2. Localities of pipeline sections system components	• Minimum vegetation must be removed for the installation of the pipeline sections system. • The owner of the land where the components are to be installed must give written approval. • Appropriate servitudes must be negotiated with the Base Commander. • Right-of-way agreements must be obtained from the Base Commander.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
3. Locality of pipeline sections	• Minimum vegetation must be removed for the installation of the pipeline sections. • The owner of the land where the station is to be installed must give written approval. • Right-of-way agreements must be obtained from the Base Commander. • The water pipelines and related equipment must be installed in such a manner that it will minimise the visual and noise impact.				
4. Environmental control officer (ECO)	• An environmental control officer must be appointed to do regular environmental audits on the project. • The ECO must comply with the following requirements: ❑ He/she must be independent from the applicant. ❑ He/she must have at least 5 years' experience as environmental assessment practitioner. ❑ He/she must be registered with the SA Council for Natural Scientific Professions (SACNASP).				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
5. Occupational safety and health of construction workers	• All the requirements of the Occupational Health and Safety Act (Act No 85 of 1993) must be met. • All the requirements of the Construction Regulations of 7 February 2014 must be met. • The contractor must submit a Health and Safety Plan to Independent Development Trust for approval prior to site establishment. • Daily safety toolbox talks must be held with all construction workers and must be recorded in writing. • All construction workers and visitors on site must wear the prescribed personal protective clothing and equipment. • All daily inspection registers must be completed as required by the Construction Regulations.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
6. Possible damage to utility services	• Right-of-way agreements must be obtained from provincial and municipal roads authorities, if necessary. • The construction contractor must locate all possible utility services prior to excavation work. • Written approval for rights-of-way must be obtained from all utility service providers, including Telkom, Eskom Transmission, Eskom Distribution and any other affected utility suppier. • The owners of utility services must be notified before excavation is done and requested to send a supervisor to the site. • If utility services are damaged, the owner of the service must be notified immediately and the service must be repaired to the satisfaction of the owner.				
7. Construction noise	• Noise caused by construction activities must be minimised. • Construction activities must be limited to daylight hours, between 06:00 and 18:00. • Adjacent inhabitants must be notified if excessive noise will be produced.				
8. Airborne emissions	• All construction vehicles must be maintained in good order to ensure that minimum exhaust smoke and gases are emitted. • No open fires must be allowed on site. • No waste may be burnt on site. • Dust on dirt roads must be suppressed by means of water spraying.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
9. Offloading of heavy equipment and machinery	• No bystanders must be allowed nearby. • Traffic must be controlled to avoid disruption. • If necessary, the traffic departments of Secunda, Balfour and Sasolburg must be requested for assistance. • Roads and access ways must never be blocked. • Material and equipment must be stored in a safe place with proper fencing around it and a lockable gate with proper security access control.				
10. Removal and storage of topsoil	• The top 150 mm layer of soil contains valuable plant nutrients that must be preserved. • Removed topsoil must be stored separately and must be replaced last, after bedding, padding and backfilling. • Topsoil must be stored in such a manner that wind erosion would be minimised. • Topsoil must be stored in such a manner that water erosion would be minimised.				
11. Security of adjacent properties	• Construction workers may not wander off site without permission. • The construction contractor must keep a Complaints Register on site in which all complaints from adjacent Base Commanders and inhabitants must be recorded with an indication of how and when each complaint was resolve. • No construction camp may be established on site. • Land may never be accessed without written approval from the owner or his/her designated representative. • Construction workers must be made aware of the fact that access top private properties without permission is forbidden.				
12. Removal of fences and gates	• Where fences and gates have to be removed for access to the construction area, approval must be obtained from the Base Commander. • All removed fences and gates must be replaced in the same or better condition.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
13. Damage to artificial water drainage systems	• Drainage lines, pipes and canals installed to control storm water flow, may not be damaged. • If damage occurred, the owner of the system must be notified and the system must be repaired immediately to the satisfaction of the owner. • The prescriptions of the consulting engineers must always be applied.				
14. Production of construction waste and spoil	• FOD must be managed on site. • Construction waste such as soil, rocks, stones and waste vegetation must be stored separately and neatly where it can cause no harm to people and livestock. • Waste vegetation may not be burnt on site. • Waste trees such as Blue Gum, Black Wattle and Pine may be cut up and donated to local inhabitants as firewood. • Waste soil must be used as backfill material. • Residual waste rocks and stones must be levelled in accordance with the requirements of the Base Commander and must blend into the natural environment.				
15. Xenobiotic contamination by fuel, lubricants and chemical substances such as paint and solvents	• Spillages of xenobiotic materials on soil and in water must be avoided. • If soil is contaminated, the spilled material must immediately be excavated immediately to a depth of 300 mm, segregated in a plastic container and taken to the Holfontein hazardous waste disposal site for further handling. • Spilled materials may not be treated as general waste. • No vehicles may be serviced on site. • When construction vehicles are parked on site, drip trays must be placed under them to catch leaking oil or diesel. • Xenobiotic substances may never be spilled into a natural water source. In the unlikely event of it happening, the Department of Water Affairs and Forestry must be notified immediately.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
16. Construction worker welfare facilities	• The construction facilities must comply with the Occupational Health and Safety Act. • Construction workers must be educated about the serious risks of HIV/AIDS and workers must have access to condoms. • The conditions on the construction site must be discussed with all workers during every safety toolbox talk and must be recorded in writing. • The Site Supervisor must complete a daily inspection register in which the following points are checked: ❑ Food handling facilities. ❑ Toilets. ❑ Washing facilities, with hot and cold water. ❑ No open fires. ❑ Mixing of males and females. ❑ Storage of dangerous materials. ❑ Electrical connections. ❑ Facilities to dry washed clothes. ❑ Abuse of alcohol and other intoxicating substances.				
17. Visual effects	• Equipment and materials must be stored in a demarcated area, as far as possible out of sight for members of the public. • Excavated soil, rock and stones must be stored in low heaps to minimise the visual impact. • All complaints from interested and affected parties must be recorded in the Complaints Register.				
18. Rehabilitation of the construction area and spoil management	• The construction area must be rehabilitated after completion of the installation of water pipelines, V-drains and related equipment and related equipment and other equipment. • The affected Base Commander must sign off the rehabilitation work on his/her property as acceptable. • The ECO must sign off the rehabilitation work as acceptable, in accordance with the conditions of the EMPr.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
19. Temporary job creation	• This is a positive impact. • The construction contractor must endeavour, as far as reasonably practicable, to appoint local labourers for the construction work. • Local labourers must be trained in the following aspects: ❑ How to do the work. ❑ Safety and health in the workplace. ❑ Environmental protection on the site.				
20. Soil erosion	• Soil must be stacked as low as possible to minimise erosion caused by wind. • Adequate water drainage must be provided at the construction site to prevent erosion of soil caused by uncontrolled water flow, especially during rainy periods. • Silting of natural water sources must be prevented.				
21. Safety of nearby communities	• All open trenches and excavated holes must be barricaded to prevent members of the public and livestock from falling into it. • Construction workers may not wander off from the construction site without permission. • All construction workers must be made aware of the security requirements of private people.				
22. Crossing of tar roads	• Tar roads must be crossed in accordance with the requirements of the national, provincial and municipal roads authorities. • Damage to tar road surfaces, caused by construction vehicles, must be prevented. • If caterpillar track machines have to cross tar roads, used lorry tyres must be placed under the tracks to protect the tar surface. • Proper traffic control measures must be exercised to prevent traffic disruption and road accidents.				
23. Safety of pedestrians near the construction site	• Pedestrian walkways must never be blocked. • Adequate and safe bypasses must be provided for pedestrians, where necessary. • All open holes and trenches must be barricaded to prevent pedestrians from falling into it.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
24. Allocation of construction contracts to local contractors	• The construction contractor must endeavour to allocate subcontracts to local contractors, as far as reasonably practicable. • The appointment of local subcontractors must be done with due cognisance of the requirements for safety and reliability of the liquid gas pipeline and related equipment.				
25. Work area restriction	• Dangerous areas at the construction site must be barricaded to prevent people from entering these areas. • Where sensitive areas have been identified such as wetlands or endangered habitat, these areas must be demarcated and barricaded to prevent access by construction workers.				
26. Training of workers	• All construction workers must be trained in the following: ❑ How to do their work. ❑ Safety and health at the workplace. ❑ Environmental protection. • Proper records must be kept of such training. • Regular Planned Task Observations must be done on site. • Weekly environmental toolbox talks must be held with all workers and a signed record must be kept.				
27. Interruption of water supply to users	• The supply of water to users may not be interrupted. • The existing water pipelines and related equipment must not be damaged by the construction activities.				
28. Disruption of traffic flow	• The normal flow of traffic may not be disrupted by construction activities. • If necessary, the traffic departments of Secunda, Balfour or Sasolburg must be requested to assist with the management of traffic. • Access roads may never be blocked.				
29. Safety of bystanders	• The construction activities will have spectator value for members of the public and job seekers. • Bystanders must be controlled to stay away from the construction activities.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
30. Removal of vegetation	• Minimum vegetation must be removed for construction purposes. • Waste vegetation may not be burnt on site. • Waste vegetation must be taken to a registered waste disposal site for disposal. • Waste trees such as Blue Gum, Black Wattle and Pine, may be cut up and provided to members of local communities for firewood. • Alien vegetation must be removed manually and not through the use of chemical herbicides. • Alien vegetation growth at water pipelines, V-drains and related equipment sections and related equipment must be controlled for at least 12 months after completion of construction.				
31. Obstruction of access roads	• Access roads to dwellings, farms, amenities, facilities and public places may not be blocked. • If an access road has to be closed temporarily, an alternative safe and convenient route must be provided. • All complaints from road users must be recorded in the Complaints Register.				
32. Sand borrowing	• Sand must be procured from commercial sand suppliers or excavated soil must be screened to comply the particle size specification. • Sand borrow pits may not be created.				
33. Water use	• If water for hydrostatic testing of water pipelines and related equipment are to be abstracted from a natural source, the following written approvals are required: ❑ The Base Commander on whose property the water source is situated. ❑ The Department of Water Affairs and Forestry. • It is recommended that water be purchased from the local municipality. • Water used for hydrostatic testing (waste water) may only be discharged into a natural water source after laboratory analysis has confirmed that the quality complies with the discharge specifications of the Department of Water Affairs and Forestry.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
34. Requirements of Local Municipality	• All the bylaws of the City Of Tshwane must be obeyed.				
35. Crossing of natural watercourses (rivers, spruite and wetlands)	• An integrated water use license must be obtained from the Department of Water Affairs and Forestry for the crossing of rivers, spruite and wetlands, in accordance with Sections 21 l and (i) of the National water Act (Act 36 of 1998). • All the conditions of the water use license must be met during all phases of the project.				
36. Consent from Base Commander	• Private land may never be accessed without written consent from the Base Commander. • Unauthorised access to land must be avoided.				
37. Disruption of air force base activities	• Operational activities at the air force base may never be disrupted. • Water pipelines, V-drains and related equipment and related equipment must be buried deep enough to allow the base r to continue with normal activities. • The requirements of the Base Commander must be met.				
38. Land use	• The construction area must be kept as small as reasonably practicable, to minimise the environmental footprint and temporary sterilisation of land. • The construction and operation of water pipelines, V-drains and related equipment and related equipment must not necessitate the rezoning of land. • The pipeline sections, valve boxes, telemetry equipment and any other related equipment must be located in an area where normal land use would not be affected. • The contours of agricultural land must be preserved. • Water drainage furrows must not be altered or damaged in any way unless prescribed by the consulting engineers.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
39. Heritage artefacts	• Archaeological artefacts discovered during construction must be labelled and preserved. • If the presence of artefacts is noted during excavation of the trench, excavation work must be stopped immediately and the SA Heritage Resources Agency (SAHRA) must be notified. • All further excavation work must be done under direct supervision of a qualified archaeologist or palaeontologist. • Artefacts must never be destroyed or damaged.				
40. Heritage sites	• Water pipelines, V-drains and related equipment and related equipment' route must avoid all gravesites. • No heritage object may be removed or altered to make way for the liquid gas pipeline and related equipment. • Water pipelines, V-drains and related equipment and related equipment' route must avoid all heritage objects and sites.				
41. Cathodic corrosion protection system	• No damage must be done to the cathodic corrosion protection system of water pipelines and related equipment.				
42. Excavation work where the water table is high,	• Excavations must take place under constant supervision. • Water that seeps into the trench must be pumped out constantly. • The health and safety plan of the contractor must make provision for this impact.				
43. Prevention of veld fires	• No open fires may be allowed on site. • Workers must be trained to prevent veld fires.				
44. Cement mixing	• Cement may only be mixed on an impermeable layer. • No residual cement or concrete may be left on site after completion of the work. • Residual cement or concrete must be disposed of a at a registered general waste landfill site.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
45. Waste management	• No FOD may be generated in an uncontrolled manner at any area of the base. • Waste bins with lids must be available at all work places. • No littering is allowed on site and the surrounding environment. • No waste may be burned or buried on site. • Workers must be educated about waste management as contained in this EMPr. • General waste must be removed from site at least weekly and disposed of at a registered general landfill site. • Hazardous waste must be removed from site at completion of the work and disposed of at a registered hazardous landfill site such as Holfontein. • Waste generated on site must be segregated in plastic, glass and metal. • All efforts must be made to recycle waste.				
46. Method statements	• The contractor must make available method statements for all activities performed on site.				
47. Risk assessment	• The contractor shall conduct an environmental risk assessment prior to the pipeline sections work.				
48. On-site emergency plan	• The contractor must compile an on-site emergency response plan for the work. • All workers on site must be trained in the implementation and use of the emergency plan.				
49. Alien vegetation growth (weeds)	• Any alien vegetation growth at the work area must be eradicated manually to prevent proliferation. • Alien vegetation must be eradicated by the contractor for a period of one year after completion of the work.				
50. The construction area must be rehabilitated.	• Rehabilitation must take place in accordance with all the requirements of the various authorities. • Written approval for all rehabilitation work must be obtained in writing from affected Base Commanders. • Rehabilitation must take place in accordance with all the conditions of any environmental authorisation.				

Potential Impact	Management Action Required (mitigation of negative impacts and enhancement of positive impacts)	Audit finding	Non-compliance	Corrective action	Responsible person
51 Management of construction spoil	• Excavated soil must be used as backfill for the trench, as far as possible. • Residual soil must be landscaped in such a way that it blends in with the natural environment. • Rocks and stones must be levelled and spread to blend in with the natural environment. • Residual soil must be used to create berms to control storm water flow and to prevent soil erosion. • Soil must temporarily be stacked during construction in such a way that wind erosion will be minimised i.e. keep the stack height as low as possible.				
52. Residual water in water pipelines and related equipment	• Residual water must be sampled and analysed against the quality standards of DWAF laid down for discharges into the natural environment. • Only if the water quality meets those standards, may it be discharged into the environment. • A SANAS accredited laboratory must perform analysis.				
53 Spillage of fuel into surface water sources	• The spillage of liquid hydrocarbon fuel or oil must be prevented at all costs.				
54. Spillage of fuel into underground water sources	• The spillage of liquid hydrocarbon fuel or oil must be prevented at all costs.				
55. Spillage of fuel and the creation of a fire	• Spilled or leaked fuel such as petrol and diesel create a serious fire risk. • The contractor must compile an Emergency Management Plan that must makes provision for such emergencies. • No fires are allowed at the base.				

PG-03.1 (EC) SITE INFORMATION – (GCC (2010) 2nd EDITION: 2010)

Project title:	***DRMS: DOD: SAAF: SWARTKOP AIRFORCE BASE: REPLACEMENT AND UPGRADING OF CIVIL ENGINEERING SERVICES AND SINKHOLE REHABILITATION: Completion Contract***		
Tender no:	*H21/ 001 AI*	**Reference no:**	

C4 Site Information

C4.1 LOCALITY PLAN

C4.2 CONSTRUCTION NOTICE BOARD

C4.3 CONDITIONS ON SITE: GEOTECHNICAL REPORT.

PG-03.1 (EC) SITE INFORMATION – (GCC (2010)2nd EDITION: 2010)

Tender no: H21/ 001 AI

C4.1 LOCALITY PLAN

The Locality Plan is included in the book of drawings.

C4.2 CONSTRUCTION NOTICE BOARD

A copy of the drawing of the construction notice board is included in the book of drawings.

C4.3 CONDITIONS ON SITE: GEOTECHNICAL REPORT

This project is being executed in a geological area classified as a “High Risk Area”, that is an area which is subject to highly unstable subsurface conditions that might result in catastrophic ground movement evident by sinkhole or doline formation.

Should the tenderer wish to obtain access to any specific document about any site / property listed hereunder, such access for inspection can be granted, but duplication thereof will not be allowed / permitted. The documents are available for viewing at the address as listed below.

5130: DOD: Gauteng: Swartkop Air force Base: Mobile Development Wing: Land Utilization and Priority Monitoring Report.
5130: DOD: Gauteng: Swartkop Air force Base: Main Runway Dolomite Stability Investigation- May 2006.
5130: Dolomite Status Certificate.
5137: DOD: Gauteng: Swartkop Air force Base: Legsato.
5137: Dolomite Status Certificate 200504.
5214: DOD: Gauteng: Swartkop Air force Base: Hanger 10 Door subsidence.
5214: DOD: Gauteng: Swartkop Air force Base: Hanger 10 Door Doors.
5215: DOD: Gauteng: Swartkop Air force Base: Hanger 11 Sinkhole.
5221: DOD: Gauteng: Pipeline from Genl. Kemp to Swartkop- Dolomite stability investigation Sinkhole.
5245: DOD: Gauteng: Swartkop Air force Base- Memorial dolomite stability investigation.

For any further geological enquiries, contact the respective person at the details as indicated below.

The National Department of Public Works
Cnr. Bosman Str. and Madiba Str.
Pretoria
Office of Mr. John Blackmore
Tel: 012 406 1134

C4.5 TENDER DRAWINGS

LIST OF DRAWINGS
(Drawings can be requested electronically)

The following drawings shall be issued during the tender period to form part of tender documentation.
Where applicable, drawings could be re-issued to the Contractor at commencement of the construction phase.

DRAWING NO:	DESCRIPTION:
	COVER PAGE
N2281B11001	GENERAL CONSTRUCTION NOTES
N2281B5001	GENERAL LAYOUT: BENCHMARK DRAWING
N2281G1001	GENERAL SERVICES – SHEET REFERENCE
N2281SW1000	SHEET REFERENCE- NEW STORM WATER RETICULATION
N2281SW1004R3	GENERAL LAYOUT- PROPOSED STORMWATER RETICULATION SHEET 3 OF 7
N2281SW1005R4	GENERAL LAYOUT- PROPOSED STORMWATER RETICULATION SHEET 4 OF 7
N2281SW1006R3	GENERAL LAYOUT- PROPOSED STORMWATER RETICULATION SHEET 5 OF 7
N2281SW1007R4	GENERAL LAYOUT- PROPOSED STORMWATER RETICULATION SHEET 6 OF 7
N2281SW1008R1	GENERAL LAYOUT- PROPOSED STORMWATER RETICULATION SHEET 7 OF 7
N2281SW3001	STORMWATER - TYPICAL DETAILS: KERB INLET AND MANHOLE
N2281SW3002	STORMWATER - TYPICAL DETAILS: OIL/WATER SEPERATOR AND GRID INLETS
N2281SW3003	STORMWATER - TYPICAL DETAILS: STILLING BASINS AND TRENCH BEDDING
N2281SW3004	STORMWATER - TYPICAL DETAILS: CANALS, DUCTS AND EARTH FILL BERMS
N2281SW3005	STORMWATER - TYPICAL DETAILS: WELDING FOR HDPE STORMWATER MANHOLES
N2281SW3006	STORMWATER - TYPICAL DETAILS: CONSTRUCTION AND EXPANSION JOINTS
N2281SW3007	STORMWATER - TYPICAL DETAILS: MANHOLE CONFIGURATIONS
N2281SW3008	STORMWATER – TYPICAL DETAILS
N2281SW3009	STORMWATER – TYPICAL DETAILS; SEGMENTED PAVING
N2281SW3010	STORMWATER – TYPICAL DETAILS; CONCRETE APRON
N2281SW4001R1	GENERAL LAYOUT- PROPOSED STORMWATER ACOMMODATION AROUND BUILDINGS (SHEET 1 OF 5)
N2281SW4002R2	GENERAL LAYOUT- PROPOSED STORMWATER ACOMMODATION AROUND BUILDINGS (SHEET 2 OF 5)
N2281SW4003	GENERAL LAYOUT- PROPOSED STORMWATER ACOMMODATION AROUND BUILDINGS (SHEET 3 OF 5)
N2281SW4004	GENERAL LAYOUT- PROPOSED STORMWATER ACOMMODATION AROUND BUILDINGS (SHEET 4 OF 5)
N2281S1001	GENERAL LAYOUT - NEW SEWER RETICULATION SHEET REFERENCE

N2281S1003R4	GENERAL LAYOUT – PROPOSED SEWER RETICULATION SHEET 2 OF 6
N2281S1004R3	GENERAL LAYOUT - PROPOSED SEWER RETICULATION SHEET 3 OF 6
N2281S1005R3	GENERAL LAYOUT - PROPOSED SEWER RETICULATION SHEET 4 OF 6
N2281S1006R2	GENERAL LAYOUT - PROPOSED SEWER RETICULATION SHEET 5 OF 6
N2281S1007R1	GENERAL LAYOUT - PROPOSED SEWER RETICULATION SHEET 6 OF6
N2281S2007R1	SEWER RETICULATION: LONGSECTIONS SHEET 6 OF 6
N2281S3001	SEWER RETICULATION: GENERAL DETAILS SHEET 1 OF 3
N2281S3002	SEWER RETICULATION: GENERAL DETAILS SHEET 2 OF 3
N2281S3003R1	SEWER RETICULATION: GENERAL DETAILS SHEET 3 OF 3
N2281S3004R1	MANHOLE CONFIGURATIONS SHEET 1 OF 2
N2281S3005	MANHOLE CONFIGURATIONS SHEET 2 OF 2
N2281S3006	SEWER DETAILS – SHOWER PAN AND LEAK DETECTION MANHOLE
N2281E3001	ELECTRICAL GENERAL DETAILS SHEET 1 OF 2
N2281E3002	ELECTRICAL GENERAL DETAILS SHEET 2 OF 2
N2281W1001	GENERAL LAYOUT - NEW WATER RETICULATION- SHEET REFERENCE
N2281W1003R4	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 2 OF 7
N2281W1004R3	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 3 OF 7
N2281W1005	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 4 OF 7
N2281W1006R1	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 5 OF 7
N2281W1007R1	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 6 OF 7
N2281W1008R1	GENERAL LAYOUT - PROPOSED WATER RETICULATION- SHEET 7 OF 7
N2281W3001R1	WATER RETICULATION: NODAL CHAMBER DETAILS SHEET 1 OF 3
N2281W3002R2	WATER RETICULATION: NODAL CHAMBER DETAILS SHEET 2 OF 3
N2281W3003R1	WATER RETICULATION: NODAL CHAMBER DETAILS SHEET 3 OF 3
N2281W3004R1	WATER RETICULATION: BUILDING CONNECTION DETAILS SHEET 1 OF 2
N2281W3005R1	WATER RETICULATION: BUILDING CONNECTION DETAILS SHEET 2 OF 2
N2281W3006	WATER RETICULATION: MANHOLE COVER AND FRAME DETAILS
N2281W3007	WATER RETICULATION: FIRE HYDRANTS DETAILS
N2281W3008	WATER RETICULATION: TYPICAL DETAILS
N2281W3009	WATER RETICULATION: TYPICAL THRUST BLOCK DETAILS
N2281W3010R3	WATER RETICULATION: NODAL DESCRIPTION LIST SHEET 1 OF 4
N2281W3011R2	WATER RETICULATION: NODAL DESCRIPTION LIST SHEET 2 OF 4
N2281W3012R1	WATER RETICULATION: NODAL DESCRIPTION LIST SHEET 3 OF 4
N2281W3012R1	WATER RETICULATION: NODAL DESCRIPTION LIST SHEET 4 OF 4

N2281W3012R1	PROPOSED ROAD CROSSING: PLAN VIEW, SECTION AND DETAILS
N2281W3013	WATER RETICULATION: PIPE MARKER DETAILS
N2281W3014R1	WATER RETICULATION: FIRE HYDRANT BOOSTER CHAMBER
N2281W3015	WATER RETICULATION: CONCRETE SERVICE CHANNEL
N2281W6001R5	WATER RETICULATION: FIRE PUMP STATION
N2281W6002R4	WATER RETICULATION: FIRE PUMP STATION
N2281W6003R3	WATER RETICULATION: FIRE PUMP STATION
N2281W6004R1	WATER RETICULATION: FIRE PUMP STATION
N2281W6005	WATER RETICULATION: FIRE PUMP STATION; REINFORCING
N2281W6006	WATER RETICULATION: FIRE PUMP STATION; REINFORCING