



TENDER DOCUMENT

BID No: ALMT 14/2025

THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI DAM

VOLUME 1

ISSUED BY	PREPARED BY
MUNICIPAL MANAGER	CLIENT REPRESENTATIVE
CHIEF ALBERT LUTHULI MUNICIPALITY PRIVATE BAG X719 CAROLINA 1185	KUFANIKIWA CONSULTING 11 DERBY PLACE, DERBY DOWNS OFFICE PARK, FOREST SQUARE, UNIT 6, WESTVILLE, 3630
Tell: +27 17 843 4000 Fax: +27 17 843 4001	Tell: 031 701 1038 Fax: 031 701 0963

CIDB GRADING: 9CE

REGISTERED NAME OF TENDERER: _____

CLOSING DATE: 10th JULY 2026

TIME: 12H00

TENDER AND CONTRACT

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TENDERING PROCEDURES



T1.1: TENDER NOTICE AND INVITATION TO TENDER

The Municipality hereby invites reputable and well experienced service providers to submit tenders for the below-mentioned projects. The services providers must comply with the VAT Act. Tender documents will be available on e-tender, municipal website and also at Carolina Municipal Offices from 10 June 2026 at cashiers point during office hours upon payment of a non-refundable printing fee of R1 012.15 and can also be downloaded on the municipal website or e-tenders free of charge.

Ref No	Description	Evaluation Criteria	Compulsory Briefing	CIDB Grading	Closing Date
ALMT 14/2025	The Construction of Empuluzi/Methula Bulk Water Supply Scheme in Chief Albert Luthuli Local Municipality, Phase 1, Empuluzi Dam.	Functionality, the lowest acceptable tender will determine the Preferential point system to be used: 80/10 or 90/10	12 June 2026 @ 11am Venue: Chief Albert Luthuli Municipality, Mpuluzi Unit office, Mayflower 2330	9CE or Higher	10 July 2026 @ 12:00

Sealed envelopes must be addressed to: The Municipal Manager,
Chief Albert Luthuli Municipality
PO Box 24, CAROLINA, 1185

marked with the correct bid number or deposit it in the **'TENDER BOX'** situated at Chief Albert Luthuli Municipality Offices, 28 Church Street, CAROLINA, **no later than 12H00 on the specified closing date per tender.**

A preferential point system shall apply whereby this contract will be allocated to a bidder in accordance with the Preferential Procurement Regulation 2022 and as defined in the conditions of bid in the bid document, read in conjunction with the Preferential Procurement of Chief Albert Luthuli Municipality, where 90 points will be allocated in respect of price and 10 points in respect of the Chief Albert Luthuli Municipal objectives.

Chief Albert Luthuli Municipality reserves the right to accept and/or not to accept the lowest priced or any other tender. No late, telephonic, facsimile or e-mail tenders will be accepted.

According to the Municipality Supply Chain Regulations issued by the Minister of Finance in terms of Section 168 of the Municipal Finance Management Act, Act 56 of 2003, persons within the organs of the state, like Councillors, and other elected representatives, full time employees and other directors of the public and municipal entities are prohibited from being eligible to bid or be awarded a contract to provide any services to the municipality.

If you do not hear from the Municipality within 90 working days, please consider your tender unsuccessful.

Bidders are encouraged to contact the contact person below for procurement and technical enquiries to ensure compliance with the tender conditions and specifications:

Procurement Enquiries: Mr. JA Nkosi
Ms. AT Mamba

Email: nkosija@albertluthuli.gov.za
Email: mambaat@albertluthuli.gov.za

Technical Enquiries: Mr. B Thela
Ms. S Mngadi

Email: bonganit@albertluthuli.gov.za
Email: water@kufanikiwa.co.za

Employer

Municipal Manager
CHIEF ALBERT LUTHULI Municipality
PO Box 24,
CAROLINA,
1185
Website: www.albertluthuli.gov.za

T1.2 TENDER DATA

The conditions of tender are those contained in the latest edition of SANS 10845-3, *Construction Procurement – Part 3: Standard conditions of tender*.

SANS 10845-3 makes 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 provisions of SANS 10845-3.

Each item of data given below is cross-referenced to the clause in SANS 10845-3 to which it mainly applies.

Clause number TENDER DATA

F.1.1 The employer is **Chief Albert Luthuli Local Municipality**

F.1.2 The tender documents issued by the employer comprise:

(a) The Tender Document consists of the following:

TENDER

T1: Tendering Procedures

T1.1: Tender Notice and Invitation to Tender

T1.2: Tender Data

T2: Returnable Documents

T2.1: List of Returnable Documents

CONTRACT

Part 1: Agreements and Contract Data

C1.1: Form of Offer and Acceptance

C1.2: Contract Data

C1.3: Forms of Security

Part 2: Pricing Data

C2.1: Pricing Instructions

C2.2: Bill of Quantities

Part 3: Scope of Work

C3: Scope of Work

Part 4: Site Information

C4: Site information

Drawings

The Tender Document and the drawings shall be obtained from the Employer or his authorized representative at the physical addresses stated in the Tender Notice, upon payment of the deposit stated in the Tender Notice.

F.1.4 The employer's agent is:

Name: Kufanikiwa Consulting
Address: 11 Derby Place,
Derby Downs Office Park, Forest
Square, Unit 6,
Westville, 3630
Tel: 031 701 1038
Fax: 031 701 0963
E-mail: water@kufanikiwa.co.za

The language for communications is English.

F.2.1 Eligibility

Only those tenderers who satisfy the following eligibility criteria and who provide the required evidence in their tender submissions are eligible to submit tenders and have their tenders evaluated:

Only those tenderers who are registered with the CIDB, or are capable of being so prior to the evaluation of submissions, in 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 9CE class of construction work, are eligible to have their tenders evaluated.

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 9CE 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 for an 8CE class of construction work or a value determined in accordance with Regulation 25 (1B) or 25(7A) of the Construction Industry Development Regulations.

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:

- 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 an 9CE 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 and who satisfy the following criteria:
 - 1) the employer is satisfied that such a contractor has the potential to develop and qualify to be registered in that higher grade as determined in accordance with the provisions of the *CIDB Specification for Social and Economic Deliverables in Construction Works Contracts*; and

PART T1.2: TENDER DATA
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI DAM.

- 2) the employer agrees to provide the financial, management or other support that is considered appropriate to enable the contractor to successfully execute that contract.

Site visit and clarification meeting

The arrangements for a compulsory site inspection visit and clarification meeting are as stated in the Tender Notice and Invitation to Tender.

Tenderers must sign the attendance list in the name of the tendering entity. Addenda will be issued and tenders will be received only from those tendering entities appearing on the attendance list.

Subcontracting

The tenderer shall achieve a minimum Contract Participation Goal (CPG) of 30% of the value of the works through subcontracting.

It is the intention of the Employer that specific portions of the Works be subcontracted to specialist subcontractors.

F.2.10 Pricing the tender offer

(a) Value Added Tax

The Valued Added Tax (VAT) rate shall be 15% or as otherwise provided for by legislation.

(b) The successful Tenderer shall be required to produce a VAT invoice that shall only be prepared once measurements and valuations for work done in terms of the contract offer have been agreed with the Employers agent and a certificate of payment issued.

(c) Payment of VAT to non-VAT vendors shall be processed from the month in which the Tenderers liability with the South African Revenue Services is effective.

F.2.11 Alterations to documents

A Tender offer shall not be considered if alterations have been made to the forms of tender data or contract data (unless such alterations have been duly authenticated by the Tenderer) or if any particulars required therein have not been completed in all respects.

F.2.12 Alternative tenders

No alternative tender offers will be considered

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, the details of which may be obtained from the employer's agent.

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.

PART T1.2: TENDER DATA

BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI DAM.

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 in confirming the acceptability of the detailed design.

F2.13 Submitting a Tender Offer

F.2.13.1 The Tenderer may not make an offer for only part of the services as defined in the Scope of Work.

F.2.13.3 Tender offers shall be submitted as an original only.
Parts of each tender offer communicated on paper shall be submitted as original, plus 0 copies.
Under no circumstances whatsoever may the tender forms be retyped or redrafted.

F.2.13.5 The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are:

Location of tender box: As mentioned on the tender advertisement.

F.2.15 Closing time

The closing time for submission of Tender Offers is: **12H00 on 10 July 2026, no late tenders will be accepted.** Telephonic, telegraphic, telex, electronic or emailed tenders will not be accepted.

F.2.16 Tender Offer Validity

The tender offer validity period is **90 days**.

F.2.23 Certificates

The following original or certified certificates must be provided with the tender:

- Record of Addenda to Tender Documents
- Proposed amendments and qualifications
- Preferencing Schedule: Broad Based Black Economic Empowerment Status
- Compulsory Declaration
- Municipal declaration and returnable documents
- Certificate of Attendance at a Tender Site Meeting
- Certificate of Authority of Joint Ventures/ Close corporations/ Partnership/ Company/ Sole proprietor (Certified Copies of the Identity Documents in the Case of sole proprietor)
- Registration Certificates of Entities – Joint Ventures/ Close corporations/ partnership/ Company/ Sole Proprietor
- Schedule of Tenderer's Experience
- Schedule of Key Personnel (Together with complete CV as per attached template, with **certified** qualifications)
- Format of Curriculum Vitae (CV)
- Schedule of Sub-Contractors
- Schedule of plant and equipment
- Copy of Workmen's Compensation Registration Certificate (or proof of payment of contributions in terms of the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993)
- Competence Achievement Schedule
- BBBEE Certificate / Sworn Affidavit
- Form of Intent (**project specific**) to offer a Performance Guarantee
- A copy of Tax Clearance Certificate issued by the South African Revenue Services and PIN valid for three 3 months
- Execution Programme
- Contractor's Health and Safety Declaration
- Contractor's Safety Plan
- Proforma Notification form in terms of the Occupational Health and Safety Act 1993, Construction Regulations, 2014.

F.3.4 Opening of Tender Submissions

F.3.4.2 Tenders shall be opened in accordance with the procedures stated in the Tender Data and the requirements of the two-envelope system. At the tender closing time, only the Technical Proposals (Envelope 1), Volume 1 of validly submitted tenders shall be opened in public. The name of each tenderer shall be announced and recorded.

Financial Proposals (Envelope 2), Volume 2 shall remain sealed, securely stored and unopened by the Employer until completion of the functionality evaluation and any experience verification process required in terms of the Tender Data.

Following completion of the technical evaluation process, only those tenderers who achieve the minimum functionality score and successfully satisfy all experience verification requirements shall be deemed responsive and shall proceed to the financial evaluation stage.

The Employer shall notify qualifying tenderers of the date, time and venue for the opening of Financial Proposals. At the financial opening, the names of qualifying tenderers and their tendered prices shall be announced and recorded.

Financial Proposals submitted by tenderers who fail to achieve the minimum functionality score or fail the experience verification requirements shall not be opened, considered or evaluated. Such Financial Proposals shall be retained unopened until the conclusion of the procurement process and thereafter returned unopened to the respective tenderers or otherwise disposed of in accordance with the Employer's procurement procedures.

F.3.5 Two-Envelope System

A two-envelope procedure is to be followed.

F.3.11 Evaluation of Tender Offers

Tenders will be evaluated for Functionality. Tenderers who qualify for Functionality will be evaluated further for Price and Preference only. Points for Functionality will not contribute to further evaluation. Tenderers who do not qualify will not be evaluated further.

Functionality will be scored out of 110 points. A Tenderer who scores less than **62%** for Functionality, that is, less than **69 points** will automatically be disqualified.

The 90/10 evaluation criteria will be used where Price will be allocated 90 points and Preference will be scored out of 10 points.

F.3.11.1 The procedure for evaluation of responsive Tender Offers will be Method 4: Financial Offer, Functionality and Preferences. The responsive tender with the highest total points as defined below is the preferred tender

F.3.11.2 The financial offer will be scored in terms of Formula 2, Option 1 of Table F.1 of SANS 294: 2004, which reads as follows:

$$N_{fo} = W_1 \times A$$

Where:

N_{fo} = number of tender evaluation points awarded for the financial offer;
W₁ = 90 points for rand value more than R50 000 000;
A = $[1 - (P - P_m) / P_m]$ (a negative A will be regarded as unrealistically high)

Where

P_m = the rand value of the lowest comparative offer;
P = the rand value of the Tender Offer under consideration.

F.3.11.3 (a) Functionality will include the following:

Evaluation criteria

Bids will be evaluated on functionality in accordance with the applicable Supply Chain Management (SCM) policy and tender conditions in two stages as follows: -

- 1. Stage 1 – Functionality Evaluation**
- 2. Stage 2 – Experience Verification and Client Reference/Site Verification**

Functionality will be assessed against predefined criteria with a maximum score of 110 points. Experience shall be evaluated as a mandatory functionality criterion with a minimum qualifying score. Tenderers who fail to achieve the minimum required points for experience for each criterion will be deemed non-responsive and will not be evaluated further on the remaining functionality criteria.

Only tenderers who achieve the overall minimum functionality threshold of 69 points out of 110, and who meet the minimum experience requirements, will proceed to Stage 2, where the submitted experience and reference projects may be verified through client confirmations and/or site inspections.

Following completion of Stage 2, only tenderers who successfully satisfy the experience verification requirements will be further evaluated for price and municipal objectives and be invited to the opening of financial proposals. Financial proposals of tenderers who do not meet the minimum functionality and experience verification requirements will not be opened and will be returned unopened.

TABLE	CRITERIA	MAXIMUM POINTS	MINIMUM POINTS
A1	Company Experience	30	15
A2	Organizational Structure	60	44
A3.	Financial Management Plan	10	5
A4	Quality Assurance and Control Procedures and Environmental Management	10	5
	Total Points	110	69

POINTS ALLOCATION CRITERIA

TABLE A1: EXPERIENCE, REPUTATION AND REFERENCES

The table below will be used to evaluate the Tenderer's experience on projects of a similar nature and size. Tenderers must submit supporting documentation for each project listed in the experience schedule, including a signed appointment letter, and certified certificate of completion. **Failure to provide the required documentation will result in the allocation of zero points for that project.**

Tenderer's experience forms must be fully completed by the tenderer. A full description of the project must be provided for the determination of the type of work carried out. If there is insufficient space on the provided form, Tenderers may attach a suitably typed list of projects in the same format as given below. If more than the required number of projects are provided, only two most responsive will be considered for scoring.

Tenderers should briefly describe the scope of work to allow the evaluation committee to assess that the projects are of a similar nature to the required experience. **If the Client references are not contactable, the information shall not be considered for evaluation purposes.**

NB: A maximum of 30 points and a minimum of 15 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive

TARGETED GOALS Name reference with contact details	SIMILAR PROJECTS	POINT ALLOCATION	MAX POINTS	MIN POINTS
Earth/Concrete and Rockfill Dams and Weir Construction and completion of Category II Dams as minimum, Earth Dams/Rockfill Dams, Weir ≥5m in height and Intake Towers	Two Category II Dams or more	10	10	5
	One Category II Dam	5		
	No Dam Experience	0		
Bulk Water Services Infrastructure systems Construction and completion of a combination of bulk water projects.	Three or more bulk water projects are valued at a minimum of R 300 million or more	10	10	5
	One to Two bulk water projects valued at a minimum of R 300 million or more	5		
	No bulk water projects of minimum of R 300 million or less	0		
Roads and Bridges Construction and completion of rural surfaced roads, including bridges and culverts.	Five roads and stormwater projects each valued at R50 Million and above	10	10	5
	Three roads and stormwater projects each valued at R50 Million and above	5		
	Two projects or less valued at R50 million.	0		
SUB-TOTAL: Experience and Reputation			30	15

FORM A1-1: CATEGORY II DAMS

CATEGORY	PREVIOUS EXPERIENCE	CLIENT REFERENCE
Tenderers must demonstrate experience in construction and must have completed Category I Dams as minimum, Earth Dams/Rockfill Dams, Weir ≥5m in height and Intake Towers Project 1	Project Name Project Scope Contract Value Concrete Volume Placed Weir or Dam Height	Organization: Name Contact Number Email
Tenderers must demonstrate experience in construction and must have completed Category I Dams as minimum, Earth Dams/Rockfill Dams, Weir ≥5m in height and Intake Towers Project 2	Project Name Project Scope Contract Value Concrete Volume Placed Weir or Dam Height	Organization: Name Contact Number Email

FORM A1-2: BULK WATER INFRASTRUCTURE

CRITERIA	PREVIOUS EXPERIENCE ON WATER PIPELINE	CLIENT REFERENCE
Tenderers must demonstrate experience in construction of Bulk Water Services Infrastructure systems which consist of (Bulk Water Infrastructure or Bulk Sewer Infrastructure) Project 1	Project Name Project Scope Contract Value Pipeline Material, Length and Diameter	Organization: Name Contact Number Email
Tenderers must demonstrate experience in construction of Bulk Water Services Infrastructure systems which consist of (Bulk Water Infrastructure or Bulk Sewer Infrastructure) Project 2	Project Name Project Scope Contract Value Pipeline Material, Length and Diameter	Organization: Name Contact Number Email

FORM A1-2: BULK WATER INFRASTRUCTURE

CRITERIA	PREVIOUS EXPERIENCE ON WATER PIPELINE	CLIENT REFERENCE
Tenderers must demonstrate experience in construction of Bulk Water Services Infrastructure systems which consist of (Bulk Water Infrastructure or Bulk Sewer Infrastructure) Project 3	Project Name Project Scope Contract Value Pipeline Material, Length and Diameter	Organization: Name Contact Number Email
Tenderers must demonstrate experience in construction of Bulk Water Services Infrastructure systems which consist of (Bulk Water Infrastructure or Bulk Sewer Infrastructure) Project 4	Project Name Project Scope Contract Value Pipeline Material, Length and Diameter	Organization: Name Contact Number Email

FORM A1-3: ROADS, STORMWATER AND BRIDGES

CRITERIA	PREVIOUS EXPERIENCE ON ROADS AND CROSSING	CLIENT REFERENCE
Tenderers must demonstrate experience in concrete surfaced rural road construction and concrete bridges Project 1	Project Name Project Scope Contract Value Length of the Road Type and Size of Crossing	Organization: Name Contact Number Email
Project 2	Project Name Project Scope Contract Value Length of the Road Type and Size of Crossing	Organization: Name Contact Number Email

FORM A1-3: ROADS, STORMWATER AND BRIDGES

CRITERIA	PREVIOUS EXPERIENCE ON ROADS AND CROSSING	CLIENT REFERENCE
Tenderers must demonstrate experience in concrete surfaced rural road construction and concrete bridges Project 1	Project Name Project Scope Contract Value Length of the Road Type and Size of Crossing	Organization: Name Contact Number Email
Project 2	Project Name Project Scope Contract Value Length of the Road Type and Size of Crossing	Organization: Name Contact Number Email

TABLE A2: ORGANIZATIONAL STRUCTURE

The Tenderer must provide relevant information as prescribed below for the key personnel proposed in the tender:

A CV for each key person, not exceeding 5 pages, must be attached to this schedule. For roles that require professional registration, personnel with no professional registration or who are registered at candidacy status shall not be considered from any further evaluation.

In addition, Tenderers must submit a detailed project organization structure and staffing proposal demonstrating their ability to execute the work efficiently and safely. An organogram must clearly indicate the reporting lines and interfaces between management, engineering, quality, safety, and site operations

NB: A maximum of 60 points and a minimum of 44 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive

TABLE	CRITERIA	MAXIMUM POINTS	MINIMUM POINTS
A2	Project Organogram	4	2
	Experience of Key Personnel	56	42
SUB-TOTAL		60	44

	DESCRIPTION	POINTS	MAX	MIN
1.	Excellent, fully project specific: The project organogram is comprehensive and specifically developed for the project. All key roles required for the successful delivery of the works are clearly defined, including reporting lines, responsibilities, and communication channels. The structure demonstrates a clear understanding of the project scope and effective integration of technical, construction, quality, and health and safety functions.	4	4	2
2	Good, mostly project specific: The project organogram is well presented and mostly aligned to the project requirements. Most key roles are identified with defined reporting lines and responsibilities; however, some minor aspects may not be fully detailed or tailored to the project.	2		
3.	Generic: The project organogram is submitted and generally acceptable but appears generic and not specifically tailored to the project. Key roles may be listed, but responsibilities and reporting lines are not clearly defined or aligned with the project scope. or No project organogram submitted with the bid	0		
	SUB-TOTAL PROJECT ORGANOGRAM SCORING	4	4	2

SUMMARY OF KEY PERSONNEL SCORING			
TABLE	CRITERIA	MAXIMUM POINTS	MINIMUM POINTS
1	Geotechnical Engineer	8	6
2	Contracts Manager	7	5
3	Construction Manager/ Site Agent (Dam	7	5
4	Assistant Construction Manager/ Site Agent (Bulk Water Infrastructure	7	5
5	Assistant Construction Manager/ Site Agent (Roads and Stormwater	7	5
6	Construction Health and Safety Officer	5	4
7	Foreman (Dam)	5	4
8	Foreman (Pipelines)	5	4
9	Foreman (Roads and Stormwater)	5	4
SUB-TOTAL		56	42

1. GEOTECHNICAL ENGINEER

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
`Geotechnical Engineer – Pr Tech or Pr Eng (Excavation Supervisor) (CR 13(1)(a))	Qualification and Registration	BTech/BSc/BEng in Civil Engineering or Higher with Pr Tech or Pr Eng Registration	3	3	3
	Related Project Experience	The Geotechnical Engineer must demonstrate proven experience in a minimum of three (3) completed projects involving a combination of shallow subsurface investigations and deep drilling investigations for the founding of structures and bridges. Such experience must clearly reflect competency in geotechnical assessment, interpretation, and the provision of foundation design recommendations.	3	3	2
		Proof of experience shall be submitted in the form of signed geotechnical report cover pages and/or relevant extracts. These documents must clearly indicate the project name, scope of work, the role of the Geotechnical Engineer, and the extent of their direct involvement.			
		In addition, the submission must include reference letters from respective clients for the cited projects. The reference letters shall be on the client’s official letterhead, duly signed, and must confirm the Geotechnical Engineer’s role, performance, and satisfactory completion of the geotechnical investigations	2		
The proposed Geotechnical Engineer must demonstrate experience in at least two (2) projects with a combination of shallow investigations and deep drilling investigations for founding of structures and bridges.					
		Proof of experience shall be submitted as above			

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CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
		Less than two projects	0		
	Years of Experience as Geotechnical Engineer	10 Years and more	2	2	1
		5-9 Years	1		
		0-4 Years	0		
GEOTECHNICAL ENGINEER TOTAL				8	6

2. CONTRACTS MANAGER

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Contracts Manager (Pr Eng/ PrTech/ PrCPM)	Qualification	Bsc in Civil Engineering/ B-Tech in Civil Engineering or Higher with Pr Tech or Pr Eng Registration or PrCPM	2	2	2
	Projects	Five or more Bulk Water Supply Projects valued at R 300 million and above	3	3	2
		Three to Four Bulk Water Supply Projects valued at R 300 million and above	2		
		Less than Three Bulk Water Supply Projects valued at R 300 million	0		
	Years Experience of as Contracts Manager	15 Years and more	2	2	1
		10-14 years	1		
		Less than 10 years	0		
	CONTRACTS MANAGER TOTAL			7	5

3. SITE AGENT (DAM)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS	
Construction Manager/ Site Agent (Dam) Pr Eng/Pr Tech Eng/ Pr CPM Appointment [CR 8(1)]	Qualification	BEng/ B-Tech in Civil Engineering or Higher with Pr Tech or Pr Eng Registration or Pr CPM	2	2	2	
	Related Project Experience	One Category II Dam Project	1	3	2	
		Five or more Bulk Water Supply Projects valued at R 300 million and above	2			
		Three to Four Bulk Water Supply Projects valued at R 300 million and above	1			
		Two or less Bulk Water Supply Projects valued at R 300 million	0			
	Years of Experience as Site Agent	15 Years and more	2	2	1	
		10-14 years	1			
		0-9 Years	0			
	CONSTRUCTION MANAGER TOTAL				7	5

4. SITE AGENT (BULK WATER INFRASTRUCTURE)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Assistant Construction Manager/ Site Agent (Bulk Water Infrastructure) Appointement [CR 8(2)]	Qualification	Bsc in Civil Engineering/ B-Tech in Civil Engineering or Higher with Pr Eng; Pr Tech Eng or Pr CPM	3	3	3
	Related Project Experience	Five or more Bulk Water Supply Projects valued at R 150million and above	2	2	1
		Three to Four Bulk Water Supply Projects valued at R 150 million and above	1		
		Two or less Bulk Water Supply Projects valued at R 150million	0		
	Years of Experience as Site Agent	15 Years and more	2	2	1
		10-14 years	1		
		0-9 Years	0		
	ASSISTANT CONSTRUCTION MANAGER (WATER) TOTAL				7

5. SITE AGENT (ROADS AND STORMWATER)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Assistant Construction Manager/ Site Agent (Roads and Stormwater)	Qualification	Bsc in Civil Engineering/ B-Tech in Civil Engineering or Higher with Pr Eng; Pr Tech Eng or Pr CPM	3	3	3
	Related Project Experience	Three Roads and Stormwater Projects valued at R 50 million and above	2	2	1
		Three to Four Bulk Water Supply Projects valued at R 50 million and above	1		
		Two or less Roads and Stormwater Projects valued at R 50 million or less	0		
	Appointment [CR 8(2)] Years Experience of as Site Agent	15 Years and more	2	2	1
		10-14 years	1		
		0-9 Years	0		
ASSISTANT CONSTRUCTION MANAGER (ROADS AND STORMWATER) TOTAL				7	5

6. HEALTH AND SAFETY OFFICER

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Construction Health and Safety Officer Appointment [CR 8(5)] (Registered as professional with the SACPCMP)	Qualification	Accredited Occupational Health and Safety qualification (NQF Level 5 or higher)	1	1	1
	Related Project Experience	Three or more Bulk Water Supply Projects valued at R 100 million	2	2	2
		Less than three Bulk Water Supply Projects valued at R 100 million	0		
	Experience as Health and Safety Officer	5 to 10 Years and more	2	2	1
		3-4 years	1		
		0-2 Years	0		
CONSTRUCTION HEALTH AND SAFETY OFFICER TOTAL				5	4

7. FOREMAN (DAM)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Foreman (Dam)	Qualification	National Certificate (NQF 4) / National Diploma or Higher	1	1	1
	Related Project Experience	Three or more Bulk Water Projects with Concrete Retaining Structures valued at R 150 million and	2	2	2
		Less than three Bulk Water Projects with Concrete Retaining Structures valued at R 150 million and	0		
	Experience as Foreman	10 Years and more	2	2	1
		5-10 years	1		
		0-4 Years	0		
FOREMAN (DAM) TOTAL				5	4

8. FOREMAN (BULK WATER INFRASTRUCTURE)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Foreman (Bulk Water Infrastructure)	Qualification	National Certificate (NQF 4) / National Diploma or Higher	1	1	1
	Related Project Experience	Three or more Projects for Bulk Water Supply Projects to the value of R 150 million and above	2	2	2
		Less than two Bulk Water Supply Projects valued at R 150 million and above	0		
	Experience as Foreman	11 to 15 Years and more	2	2	1
		5-10 years	1		
		0-4 Years	0		
FOREMAN (PIPELINES) TOTAL				5	4

9. FOREMAN (ROADS AND STORMWATER)

CRITERIA	REQUIREMENTS	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Foreman (Roads and Stormwater)	Qualification	National Certificate (NQF 4) / National Diploma or Higher	1	1	1
	Related Project Experience	Three or more Roads and Stormwater projects valued at R 50 million and above	2	2	1
		Less than two Roads and Stormwater projects valued at R 50 million and above	0		
	Experience as Foreman	11 to 15 Years and more	2	2	1
		5-10 years	1		
		0-4 Years	0		
	FOREMAN (ROADS AND STORMWATER) TOTAL				5

TABLE A3: FINANCIAL MANAGEMENT PLAN

The Tenderer shall demonstrate financial capability to undertake the project through the submission of a Financial Management Plan, supported by audited financial statements for the assessment of annual turnover. Average Turnover of R300million Over Past 3 financial Years (Disqualify Criteria)

The Tenderer must submit:

1. Financial Statements for the past three (3) financial years and Independent Letter from the Auditing firm, which demonstrate compliance with the following minimum financial ratios, which must demonstrate: -
 - A current ratio of not less than 2:1
 - An acid-Test Ratio of not less than 1.5:1
 - OCF- Operating Cashflow Test

The submission of financial statement must also include

- a) Income Statement
 - b) Balance Sheet
1. A Financial Management Plan demonstration: -
 - Capital of 20 million or investments or Access to financial resources (bank facilities, credit lines, etc.)
 - Failure to meet the above minimum requirements may result in disqualification

NB: A maximum of 10 points and a minimum of 5 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive.

No	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
1	Comprehensive Financial Submission: - Average Turnover of R300million Past 3 Years - Capital of 20 million or investments - Audited financials submitted with requirement of minimum financial ratios including Income Statement & Balance Sheet - Clear proof of financial resources - Bank Rating C or better - Proof of Guarantee/Letter of intent - Independent Letter from the Auditing Firm (Confirmation of ratios)	10	10	5
2	Adequate Submission: - Average Turnover of R300million Past 3 Years - Capital of 20 million or investments - Audited Financial statements provided - Inadequate proof of Financial Resources - Bank Rating C or better - Independent Letter from the Auditing Firm (Confirmation of ratios)	5		
	Basic Submission: - No Average Turnover of R300million Past 3 Years - No proven Capital availability - Financial statements incomplete (less than 3 years submission) - Minimum financial ratios not met - Bank Rating of D, E or F	0		

TABLE A4: QUALITY ASSURANCE AND CONTROL PROCEDURE

The tenderer shall submit both the iso 9001:2015 certification and Quality Plan to get the full points. The Quality plan in line with the activities as outlined in the project specifications.

NB: A maximum of 10 points and a minimum of 5 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive

	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
1	ISO 9001:2015 Certification	10	10	
2	In house Quality Assurance	5		5
	SUB-TOTAL	10	10	5

Points for Quality Plan are allocated as shown below

SCORING	DESCRIPTION	POINTS	MAXIMUM POINTS	MINIMUM POINTS
Excellent	The Quality Assurance & Control Plan is comprehensive, project-specific, and fully tailored to the construction requirements of the dam, road, and water pipeline works. The submission demonstrates a clear understanding of the project objectives, applicable specifications, and construction methodologies. It addresses all relevant quality control procedures, testing requirements, inspection processes, material compliance, and monitoring mechanisms applicable to critical construction activities. The plan clearly identifies responsibilities, reporting structures, hold points, and corrective actions for non-conformance	5	5	5
Sub-Total for Quality Plan			5	5

TABLE A5: FUNCTIONALITY SUMMARY

		Maximum Points to be Allocated	Minimum required points	Points Claimed by Tenderer	Allocated Points
Functionality and Quality (60 Points)	Table A1	30	15		
	Table A2	60	44		
	Table A3	10	5		
	Table A4	10	5		
	Sub Total	110	69		

The minimum number of evaluation points for Functionality & Quality is 69 points.

STAGE 1 : SCORING QUALITY

TABLE A1: EXPERIENCE, REPUTATION AND REFERENCES

The functionality assessment shall be based on the tenderer's demonstrated experience in the successful completion of projects of a similar nature and complexity. Experience shall be evaluated under the following categories:

1. **Earth/Concrete and Rockfill Dams and Weir** (Construction and completion of Category II Dams as minimum, Earth Dams/Rockfill Dams, Weir ≥5m in height and Intake Towers) = **10 points shall awarded based on successful completion of Two Category II dams or more**
2. **Bulk Water Services Infrastructure systems** (Construction and completion of a combination of bulk water projects.) = **10 points shall be awarded based on the successful completion of Three or more completed bulk water Services projects to the value of 300 million per project**
3. **Roads and Bridges** (Construction and completion of rural surfaced roads, including bridges and culverts) = **10 points shall be awarded based on successful of Five or more projects valued at R50 million per project**

Tenderers must achieve a minimum functionality score of 15 out of 30 points to be considered responsive and to proceed to the next stage of evaluation.

In addition, tenderers must score at least 5 points in Category 1 (Earthfill/Concrete and Rockfill Dams and Weirs), as this category represents the core scope of the Works.

Tenderers who fail to achieve the minimum qualifying score shall be deemed non-responsive and shall not be considered further.

TABLE A2: ORGANIZATIONAL STRUCTURE

The Tenderer shall provide suitably qualified and experienced key personnel for the duration of the Contract and shall submit detailed Curriculum Vitae (CVs), qualifications, professional registrations, and proof of experience for each proposed resource. The Tenderer shall also submit a project organogram clearly indicating reporting lines, responsibilities, and communication channels for the proposed project team.

1. Points shall be awarded for each required key person based on compliance with the minimum qualification, professional registration, and relevant project experience requirements specified in the tender document.
2. A proposed key person who fully satisfies or exceeds the prescribed requirements for the position shall be awarded the maximum points allocated to that position.
3. A proposed key person who partially satisfies the prescribed requirements may be awarded reduced points in accordance with the detailed scoring criteria provided for the position.
4. A proposed key person who does not meet the minimum requirements for the position shall score zero (0) points for that position.
5. The project organogram shall be evaluated on the completeness of the proposed project structure, clarity of reporting relationships, allocation of responsibilities, adequacy of resources, and suitability for the successful execution of the Works.
6. A comprehensive, project-specific and well-defined organogram demonstrating clear lines of authority and communication shall be awarded four (4) points.
7. Tenderers must achieve a minimum score of 44 out of 60 points under Organisational Structure and Key Personnel to be considered responsive for this functionality criterion.

TABLE A3: FINANCIAL MANAGEMENT PLAN
The Tenderer shall demonstrate adequate financial capacity to successfully execute the Works by submitting the following:
1. Audited Annual Financial Statements for the most recent three (3) financial years, including the Income Statement and Balance Sheet; 2. Proof of an average annual turnover of not less than R300 million over the preceding three (3) financial years; 3. Proof of available capital, cash reserves, investments, or access to funding of not less than R20 million; 4. Evidence that the minimum financial ratios specified in the Tender Data have been achieved; 5. Clear proof of financial resources available for the execution of the Works; 6. A bank rating of C or better issued by a recognised financial institution; 7. Proof of access to performance security in the form of a guarantee facility or a Letter of Intent from an approved financial institution or insurer; 8. An independent confirmation letter from the Tenderer's Auditor verifying the financial ratios and financial standing of the Tenderer.
A maximum of 10 points and a minimum of 5 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive.
TABLE A4: QUALITY ASSURANCE AND CONTROL PROCEDURE
The Tenderer shall submit a valid ISO 9001:2015 Quality Management System certification issued by an accredited certification body. Tenderers submitting a valid ISO 9001:2015 certificate shall be awarded 10 points . Tenderers who do not possess a valid ISO 9001:2015 certificate but submit an established in-house Quality Management Plan shall be awarded 5 points . Tenderers who fail to submit either a valid ISO 9001:2015 certificate or an in-house Quality Management Plan shall be awarded 0 points.

STAGE 2: SCORING QUALITY

The purpose of **Stage 2** is to verify the accuracy and authenticity of the company experience submitted by the tenderer during **Stage 1**. The evaluation conducted during Stage 1 will not be rescored; however, the Employer reserves the right to verify all information submitted and to confirm that the awarded scores are justified.

As part of the verification process, the Employer, Evaluation Committee, and/or its appointed representatives will conduct site visits to the nominated reference projects submitted by the tenderer. Such site visits will be undertaken to verify the existence of the projects, assess the quality and standard of the completed works, confirm the tenderer's involvement in the projects, and determine the similarity of the projects to the Works under this Contract in terms of scope, complexity, and technical requirements.

The tenderer shall provide any information reasonably required by the Employer to undertake the verification process.

Verification will include but not limited to

- (a) Confirmation of the existence of the referenced projects;
- (b) Verification of the tenderer's role and level of participation in the referenced projects;
- (c) Confirmation of project values, scope of works, dates of completion, and contractual responsibilities;
- (d) Confirmation that the projects were successfully completed and commissioned;
- (e) Verification of the quality and standard of workmanship achieved on the referenced projects;

(f) Assessment of the similarity of the referenced projects to the Works under this Contract in terms of size, complexity, technical requirements, dam construction, weir construction, bulk pipelines, pump stations, mechanical and electrical installations, or other relevant infrastructure;

(g) Client reference checks with employers, engineers, project managers, or other relevant stakeholders;

The Employer may contact any client, consultant, employer, or reference provided by the tenderer and may request additional information, supporting documentation, completion certificates, photographs, or other evidence necessary to verify the submitted experience.

Should any information submitted by a tenderer be found to be materially incorrect, misleading, unverifiable, or inconsistent with the information obtained during the verification process, the Employer reserves the right to adjust the functionality score, reject the relevant project from consideration, or disqualify the tenderer from further evaluation.

Following completion of Stage 2, only tenderers whose experience and reference projects are successfully verified to the satisfaction of the Employer will proceed to the evaluation of price and specific goals and will be invited to the opening of financial proposals. Financial proposals of tenderers who fail the experience verification stage will not be opened and will be returned to the tenderer(s) unopened.

F.3.13

Acceptance of Tender Offer

F.3.13.1

Tender offers will only be accepted if:

- a) the tenderer is registered on the Central Supplier Database (CSD) for the South African government (see <https://secure.csd.gov.za/>) unless it is a foreign supplier with no local registered entity;
- b) The tenderer must provide up-to-date municipal rates account for the company or director(s) (not older than 90 days and not in arrears for more than 90 days). In the case of a lease, the lease agreement must be accompanied by the landlord's municipal rates account;
- c) the tenderer is in good standing with SARS according to the Central Supplier Database during evaluation;
- d) the tenderer submits a letter of intent from an approved insurer undertaking to provide the Performance Bond to the format included in Part C1.3 of this procurement document;
- e) the tenderer is registered with the Construction Industry Development Board (CIDB) in an appropriate contractor grading designation;
- f) the tenderer or any of its directors/shareholders is not listed on the Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business with the public sector;
- g) the tenderer has not:
 - i) abused the Employer's Supply Chain Management System; or
 - ii) failed to perform on any previous contract and has been given a written notice to this effect;
- h) the tenderer has completed the Compulsory Declaration and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process;
- i) the tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer;
- j) the employer is reasonably satisfied that the tenderer has in terms of the Construction Regulations, 2003, issued in terms of the Occupational Health and Safety Act, 1993, the necessary competencies and resources to carry out the work safely.

F.3.18

The number of paper copies of the signed contract provided by the employer is **ONE**

Annex: Standard Conditions of Tender

(As contained in Annexure F of the CIDB Standard for Uniformity in Construction Procurement)

F.1 General

F.1.1 Actions

The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently.

F.1.2 Tender Documents

The documents issued by the employer for the purpose of a tender offer are listed in the tender data.

F.1.3 Interpretation

F.1.3.1 The tender data and additional requirements contained in the tender schedules that are included in the returnable documents are deemed to be part of these conditions of tender.

F.1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

F.1.3.3 For the purposes of these conditions for the calling for expressions of interest, the following definitions apply:

- a) **comparative offer means** the tenderer's financial offer after the factors of non-firm prices, all unconditional discounts and any other tendered parameters that will affect the value of the financial offer have been taken into consideration
- b) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process; and
- c) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels
- d) **quality (functionality)** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs

F.1.4 Communication and employer's agent

Each communication between the employer and a tenderer shall be to or from the employer's agent only, and in a form that can be read, copied and recorded. Writing shall be in the English language. The employer shall not take any responsibility for non-receipt of communications from or by a tenderer. The name and contact details of the employer's agent are stated in the tender data.

F.1.5 The employer's right to accept or reject any tender offer

F.1.5.1 The employer may accept or reject any variation, deviation, tender offer, or alternative tender offer, and may cancel the tender process and reject all tender offers at any time before the formation of a contract. The employer shall not accept or incur any liability to a tenderer for such cancellation and rejection, but will give written reasons for such action upon written request to do so.

F.1.5.2 The employer may not subsequent to the cancellation or abandonment of a tender process or the rejection of all responsive tender offers re-issue a tender covering substantially the same scope of work within a period of six months unless only one tender was received, and such tender was returned unopened to the tenderer.

F.2 Tenderer's obligations

F.2.1 Eligibility

Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with employer.

F.2.2 Cost of tendering

Accept that the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer satisfy requirements.

F.2.3 Check documents

Check the tender documents on receipt for completeness and notify the employer of any discrepancy or omission.

F.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

F.2.5 Reference documents

Obtain, as necessary for submitting a tender offer, copies of the latest versions of standards, specifications, conditions of contract and other publications, which are not attached but which are incorporated into the tender documents by reference.

F.2.6 Acknowledge addenda

Acknowledge receipt of addenda to the tender documents, which the employer may issue, and if necessary apply for an extension to the closing time stated in the tender data, in order to take the addenda into account.

F.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarize themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

F.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five working days before the closing time stated in the tender data.

F.2.9 Insurance

Be aware that the extent of insurance to be provided by the employer (if any) might not be for the full cover required in terms of the conditions of contract identified in the contract data. The tenderer is advised to seek qualified advice regarding insurance.

F.2.10 Pricing the tender offer

F.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes (except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable 14 days before the closing time stated in the tender data.

F.2.10.2 Show VAT payable by the employer separately as an addition to the tendered total of the prices.

F.2.10.3 Provide rates and prices that are fixed for the duration of the contract and not subject to adjustment except as provided for in the conditions of contract identified in the contract data.

F.2.10.4 State the rates and prices in Rand unless instructed otherwise in the tender data. The conditions of contract identified in the contract data may provide for part payment in other currencies.

F.2.11 Alterations to documents

Not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations. Erasures and the use of masking fluid are prohibited.

F.2.12 Alternative tender offers

F.2.12.1 Submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted. The alternative tender offer is to be submitted with the main tender offer together with a schedule that compares the requirements of the tender documents with the alternative requirements the tenderer proposes.

F.2.12.2 Accept that an alternative tender offer may be based only on the criteria stated in the tender data or criteria otherwise acceptable to the employer.

F.2.13 Submitting a tender offer

F.2.13.1 Submit a tender offer to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

F.2.13.2 Return all returnable documents to the employer after completing them in their entirety, either electronically (if they were issued in electronic format) or by writing in black ink.

F.2.13.3 Submit the parts of the tender offer communicated on paper as an original plus the number of copies stated in the tender data, with an English translation of any documentation in a language other than English, and the parts communicated electronically in the same format as they were issued by the employer.

F.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.

F.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.6 Where a two-envelope system is required in terms of the tender data, place and seal the returnable documents listed in the tender data in an envelope marked "financial proposal" and place the remaining returnable documents in an envelope marked "technical proposal". Each envelope shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

F.2.13.7 Seal the original tender offer and copy packages together in an outer package that states on the outside only the employer's address and identification details as stated in the tender data.

F.2.13.8 Accept that the employer will not assume any responsibility for the misplacement or premature opening of the tender offer if the outer package is not sealed and marked as stated.

F.2.14 Information and data to be completed in all respects

Accept that tender offers, which do not provide all the data or information requested completely and in the form required, may be regarded by the employer as non-responsive.

F.2.15 Closing time

F.2.15.1 Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Proof of posting shall not be accepted as proof of delivery. The employer shall **not** accept tender offers submitted by telegraph, telex, facsimile or e-mail, unless stated otherwise in the tender data.

F.2.15.2 Accept that, if the employer extends the closing time stated in the tender data for any reason, the requirements of these conditions of tender apply equally to the extended deadline.

F.2.16 Tender offer validity

F.2.16.1 Hold the tender offer(s) valid for acceptance by the employer at any time during the validity period stated in the tender data after the closing time stated in the tender data.

F.2.16.2 If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period.

F.2.17 Clarification of tender offer after submission

Provide clarification of a tender offer in response to a request to do so from the employer during the evaluation of tender offers. This may include providing a breakdown of rates or prices and correction of arithmetical errors by the adjustment of certain rates or item prices (or both). No change in the total of the prices or substance of the tender offer is sought, offered, or permitted. The total of the prices stated by the tenderer shall be binding upon the tenderer.

Note: Sub-clause F.2.17 does not preclude the negotiation of the final terms of the contract with a preferred tenderer following a competitive selection process, should the Employer elect to do so.

F.2.18 Provide other material

F.2.18.1 Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment. Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive.

F.2.18.2 Dispose of samples of materials provided for evaluation by the employer, where required.

F.2.19 Inspections, tests and analysis

Provide access during working hours to premises for inspections, tests and analysis as provided for in the tender data.

F.2.20 Submit securities, bonds, policies, etc.

If requested, submit for the employer's acceptance before formation of the contract, all securities, bonds, guarantees, policies and certificates of insurance required in terms of the conditions of contract identified in the contract data.

F.2.21 Check final draft

Check the final draft of the contract provided by the employer within the time available for the employer to issue the contract.

F.2.22 Return of other tender documents

If so instructed by the employer, return all retained tender documents within 28 days after the expiry of the validity period stated in the tender data.

F.2.23 Certificates

Include in the tender submission or provide the employer with any certificates as stated in the tender data.

F.3 The employer's undertakings

F.3.1 Respond to clarification

Respond to a request for clarification received up to five working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

F.3.2 Issue Addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until seven days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who drew documents.

F.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

F.3.4 Opening of tender submissions

F.3.4.1 Unless the two-envelope system is to be followed, open valid tender submissions in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data. Tender submissions for which acceptable reasons for withdrawal have been submitted will not be opened.

F.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened, the total of his prices, preferences claimed and time for completion, if any, for the main tender offer only.

F.3.4.3 Make available the record outlined in F.3.4.2 to all interested persons upon request.

F.3.5 Two-envelope system

F.3.5.1 Where stated in the Tender Data that a two-envelope system applies, tenderers shall submit separate sealed Technical and Financial Proposals.

At the tender closing time, only the Technical Proposals of valid tenders shall be opened in the presence of tenderers' representatives who choose to attend. The Employer shall announce the name of each tenderer whose Technical Proposal has been opened.

The Technical Proposals shall be evaluated in accordance with the functionality criteria, minimum qualifying score and experience verification requirements stated in the Tender Data.

Only tenderers who obtain the prescribed minimum functionality score and successfully satisfy all experience verification requirements shall be invited to attend the opening of the Financial Proposals.

The Financial Proposals of qualifying tenderers shall be opened at a separate public opening session, the details of which shall be communicated in writing to all qualifying tenderers.

Financial Proposals of tenderers who do not meet the minimum functionality requirements or fail the experience verification process shall remain sealed and shall not be opened, evaluated or considered for award. Such sealed Financial Proposals shall be returned unopened to the tenderers at the addresses provided in their tender submissions.

stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

F.3.5.2 Evaluate the quality of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the quality evaluation more than the minimum number of points for quality stated in the tender data, and announce the score obtained for the technical proposals and the total price and any preferences claimed. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for quality.

F.3.6 Non-disclosure

Not disclose to tenderers, or to any other person not officially concerned with such processes, information relating to the evaluation and comparison of tender offers, the final evaluation price and recommendations for the award of a contract, until after the award of the contract to the successful tenderer.

F.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

F.3.8 Test for responsiveness

F.3.8.1 Determine, on opening and before detailed evaluation, whether each tender offer properly received:

- a) complies with the requirements of these Conditions of Tender,
- b) has been properly and fully completed and signed, and
- c) is responsive to the other requirements of the tender documents.

F.3.8.2 A responsive tender is one that conforms to all the terms, conditions, and specifications of the tender documents without material deviation or qualification. A material deviation or qualification is one which, in the Employer's opinion, would:

- a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,

- b) change the Employer's or the tenderer's risks and responsibilities under the contract, or
- c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

Reject a non-responsive tender offer, and not allow it to be subsequently made responsive by correction or withdrawal of the non-conforming deviation or reservation.

F.3.9 Arithmetical errors

F.3.9.1 Check responsive tender offers for arithmetical errors, correcting them in the following manner:

- a) Where there is a discrepancy between the amounts in figures and in words, the amount in words shall govern.
- b) If bills of quantities (or schedule of quantities or schedule of rates) apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.
- c) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

F.3.9.2 Consider the rejection of a tender offer if the tenderer does not correct or accept the correction of his arithmetical errors in the manner described in F.3.9.1.

F.3.10 Clarification of a tender offer

Obtain clarification from a tenderer on any matter that could give rise to ambiguity in a contract arising from the tender offer.

F.3.11 Evaluation of tender offers

F.3.11.1 General

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate it using the tender evaluation method that is indicated in the Tender Data and described below:

Method 1: Financial offer	1) Rank tender offers from the most favourable to the least favourable comparative offer. 2) Recommend highest ranked tenderer for the award of the contract, unless there are compelling and justifiable reasons not to do so.
Method 2: Financial offer and preferences	1) Score tender evaluation points for financial offer. 2) Confirm that tenderers are eligible for the preferences claimed and if so, score tender evaluation points for preferencing. 3) Calculate total tender evaluation points. 4) Rank tender offers from the highest number of tender evaluation points to the lowest. 5) Recommend tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.
Method 3: Financial offer and	1) Score quality, rejecting all tender offers that fail to score the minimum number of points for quality stated in the Tender data. 2) Score tender evaluation points for financial offer.

quality	3) Calculate total tender evaluation points. 4) Rank tender offers from the highest number of tender evaluation points to the lowest. 5) Recommend tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.
Method 4: Financial offer, quality and preferences	1) Score quality, rejecting all tender offers that fail to score the minimum number of points for quality stated in the Tender data. 2) Score tender evaluation points for financial offer. 3) Confirm that tenderers are eligible for the preferences claimed, and if so, score tender evaluation points for preferencing. 4) Calculate total tender evaluation points. 5) Rank tender offers from the highest number of tender evaluation points to the lowest. 6) Recommend tenderer with the highest number of tender evaluation points for the award of the contract, unless there are compelling and justifiable reasons not to do so.

Score financial offers, preferences and quality, as relevant, to two decimal places.

F.3.11.2 Scoring Financial Offers

Score the financial offers of remaining responsive tender offers using the following formula:

$N_{FO} = W_1 \times A$ where:

N_{FO} = the number of tender evaluation points awarded for the financial offer.

W_1 = the maximum possible number of tender evaluation points awarded for the financial offer as stated in the Tender Data.

A = a number calculated using either formulas 1 or 2 below as stated in the Tender Data.

Formula	Comparison aimed at achieving	Option 1	Option 2
1	Highest price or discount	$A = (1 + \frac{P - P_m}{P_m})$	$A = P / P_m$
2	Lowest price or percentage commission / Fee	$A = (1 - \frac{P - P_m}{P_m})$	$A = P_m / P$

where:

P_m = the comparative offer of the most favourable tender offer.

P = the comparative offer of tender offer under consideration.

F.3.11.3 Scoring on Municipal objectives

For procurement transactions with rand value greater than R50 Million (Inclusive of all applicable taxes) the specific goals as listed in table 3 below are applicable:

Table 3

Serial No	Specific Goals	Preference Points allocated out of 10	Documentation to be submitted by bidders to validate their claim for points
1.	An EME or QSE or any entity which is at least 51% owned by Historically Disadvantaged Individuals (HDI)	4	- ID Copy Or - SANAS Accredited BBBEE Certificate or sworn affidavit where applicable Or - CSD Report Or - CIPC (company registration)
2.	Located in a specific Local Municipality or District Municipality or Metro or Province area for work to be done or services to be rendered in that area	2	- ID Copy (Mandatory) Or - Office Municipal Rates Statement Or - Permission To Occupy from local chief in case of rural areas (PTO) Or

Serial No	Specific Goals	Preference Points allocated out of 10	Documentation to be submitted by bidders to validate their claim for points
			Lease Agreement
3.	An EME or QSE or any entity which is at least 51% owned by women	2	- ID Copy - CSD Report Or - CIPC (company registration)
4.	An EME or QSE or any entity which is at least 51% owned by people with disability OR An EME or QSE or any entity which is at least 51% owned by youth.	2	- ID Copy (Mandatory) Or - Medical Certificate Or - South African Social Security Agency (SASSA) registration Or - National Council for Persons with Physical Disability in South Africa registration (NCPDPSA) - ID Copy - CSD Report Or - CIPC (company registration)

F.3.11.4 Scoring quality (functionality)

Score quality in each of the categories stated in the Tender Data and calculate total score for quality.

F.3.12 Insurance provided by the employer

If requested by the proposed successful tenderer, submit for the tenderer's information the policies and / or certificates of insurance which the conditions of contract identified in the contract data, require the employer to provide.

F.3.13 Acceptance of tender offer

F.3.13.1 Accept tender offer only if the tenderer complies with legal requirements stated in the Tender Data.

F.3.13.2 Notify the successful tenderer of the employer's acceptance of his tender offer by completing and returning one copy of the form of offer and acceptance before the expiry of the validity period stated in the tender data, or agreed additional period. Providing the form of offer and acceptance does not contain any qualifying statements, it will constitute the formation of a contract between the employer and the successful tenderer as described in the form of offer and acceptance.

F.3.14 Notice to unsuccessful tenderers

After the successful tenderer has acknowledged the employer's notice of acceptance, notify other tenderers that their tender offers have not been accepted.

F.3.15. Prepare contract documents

If necessary, revise documents that shall form part of the contract and that were issued by the employer as part of the tender documents to take account of:

- addenda issued during the tender period,
- inclusion of some of the returnable documents,
- other revisions agreed between the employer and the successful tenderer, and d) the schedule of deviations attached to the form of offer and acceptance, if any.

F.3.16 Issue final contract

Prepare and issue the final draft of contract documents to the successful tenderer for acceptance as soon as possible after the date of the employer's signing of the form of offer and acceptance (including the schedule of deviations, if any). Only those documents that the conditions of tender require the tenderer to submit, after acceptance by the employer, shall be included.

F.3.17 Complete adjudicator's contract

Unless alternative arrangements have been agreed or otherwise provided for in the contract, arrange for both parties to complete formalities for appointing the selected adjudicator at the same time as the main contract is signed.

F.3.18 Provide copies of the contracts

Provide to the successful tenderer the number of copies stated in the Tender Data of the signed copy of the contract as soon as possible after completion and signing of the form of offer and acceptance.

RETURNABLE DOCUMENTS

T2.1 LIST OF RETURNABLE DOCUMENTS

The tenderer must complete the following returnable documents:

1. Returnable Schedules required only for tender evaluation purposes

- FORM A1. Invitation to Bid (**MBD1**)
- FORM A2.1 Record of Addenda to Tender Documents
- FORM A2.2 Proposed amendments and qualifications
- FORM A3.1. Preferencing Schedule: B-BBEE Status (**MBD 6.1**)
- FORM A3.2. B-BBEE Compulsory Declaration (In case of a JV)
- FORM A4. Compulsory Enterprise Questionnaire
- FORM A5. Certificate of Attendance at a Tender Site Meeting
- FORM A6. Certificate of Authority of Joint Ventures/ Close corporations/ Partnership/ Company/ Sole proprietor (Certified Copies of the Identity Documents in the Case of sole proprietor)
- FORM A7. Registration Certificate of Entity and Bank rating
- FORM A8. Schedule of Tenderer's Experience
- FORM A9.1. Schedule of Key Personnel
- FORM A9.2. Format of Curriculum Vitae (CV)
- FORM A10. Schedule of Sub-Contractors
- FORM A11. Schedule of plant and equipment
- FORM A12. Certificate of Registration with CIDB
- FORM A13. Declaration certificate for local production and content for designated sectors (**MBD 6.2**)
- FORM A14. Competence Achievement Schedule
- FORM A15. Registration on National Treasury Central Supplier Database
- FORM A16. Form of Intent to offer a Performance Guarantee
- FORM A17. An Original Tax Clearance Certificate issued by the South African Revenue Services (**MBD 2**)
- FORM A18 Declaration of Interest (**MBD 4**)
- FORM A19. Declaration for Procurement above R10 Million (**MBD 5**)
- FORM A20. Declaration of Bidder's Past Supply Chain Management Practices (**MBD8**)
- FORM A21. Certificate of Independent Bid Determination (**MBD 9**)

2. Other documents that will be incorporated into the contract

- FORM B1. Authority of Signatory
- FORM B2. Execution Programme
- FORM B3. Contractor's Health and Safety Declaration
- FORM B4. APPLICATION FOR A PERMIT TO DO CONSTRUCTION WORK, Regulation 3(2) of Construction Regulations, 2014.

FORM A1: PART A - INVITATION TO BID

MBD 1

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY					
BID NUMBER:	ALMT14/2025	CLOSING DATE:	10/07/2026	CLOSING TIME:	12H00
DESCRIPTION	THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY 1				
THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM.					
BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT (STREET ADDRESS)					
Chief Albert Luthuli Municipal Offices, 28 Church Street, Carolina					
SUPPLIER INFORMATION					
NAME OF BIDDER					
POSTAL ADDRESS					
STREET ADDRESS					
TELEPHONE NUMBER	CODE		NUMBER		
CELLPHONE NUMBER					
FACSIMILE NUMBER	CODE		NUMBER		
E-MAIL ADDRESS					
VAT REGISTRATION NUMBER					
TAX COMPLIANCE STATUS	TCS PIN:		OR	CSD No:	
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX]	☐ Yes ☐ No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT		☐ Yes ☐ No
[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES & QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]					
ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?	☐ Yes ☐ No [IF YES ENCLOSE PROOF]		ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED?		☐ Yes ☐ No [IF YES, ANSWER PART B:3]
TOTAL NUMBER OF ITEMS OFFERED	Refer to BOQ		TOTAL BID PRICE		N/A, only applicable on Volume 2
SIGNATURE OF BIDDER			DATE		
CAPACITY UNDER WHICH THIS BID IS SIGNED					
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:			TECHNICAL INFORMATION MAY BE DIRECTED TO:		
DEPARTMENT	SUPPLY CHAIN UNIT		CONTACT PERSON	Mrs S Mngadi	
CONTACT PERSON	Mr. JA Nkosi		TELEPHONE NUMBER	031 701 1038	
TELEPHONE NUMBER	017 843 4000		FACSIMILE NUMBER	031 701 0963	
FACSIMILE NUMBER			E-MAIL ADDRESS	water@kufanikiwa.co.za	
E-MAIL ADDRESS	nkosija@albertluthuli.gov.za				

FORM A1: PART B - TERMS AND CONDITIONS FOR BIDDING

MBD 1(Cont.)

1. BID SUBMISSION:
1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION. 1.2. ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE 1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.
2. TAX COMPLIANCE REQUIREMENTS
2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS. 2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS. 2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA. 2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3. 2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID. 2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER. 2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.
3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS
3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)? 3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA? 3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA? 3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA? 3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION? ☐ YES ☐ NO ☐ YES ☐ NO ☐ YES ☐ NO ☐ YES ☐ NO ☐ YES ☐ NO IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.

**NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.
 NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.**

SIGNATURE OF BIDDER:

CAPACITY UNDER WHICH THIS BID IS SIGNED:

DATE:

FORM A2.1: Record of Addenda to tender documents

We confirm the following communications received from the Employer OR Employers Agent before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer

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

Attach additional pages if more space is required.

Signed _____

Date _____

Name _____

Position _____

Tenderer _____

FORM A2.2: Proposed amendments and qualifications

The Tenderer should record any deviations or qualifications he may wish to make to the tender documents in this Returnable Schedule. Alternatively, a tenderer may state such deviations and qualifications in a covering letter to his tender and reference such letter in this schedule.

The Tenderer's attention is drawn to clause 5.8 of SANS 10845-3 regarding the employer's handling of material deviations and qualifications.

Page	Clause or item	Proposal

Signed_____Date_____

Name_____Position_____

Tenderer_____

FORM A3.1: Preferencing schedule: Municipal Objectives

This preference form must form part of all tenders invited. It contains general information and serves as a claim form for preference points for specific goals.

NB: BEFORE COMPLETING THIS FORM, TENDERERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF THE TENDER AND PREFERENTIAL PROCUREMENT REGULATIONS, 2022.

1. GENERAL CONDITIONS

1.1 The following preference point systems are applicable to invitations to tender:

- 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 Preference Points System to be applied (tick whichever is applicable).

- ☐ The applicable preference point system for this tender is the **80/20** preference point system.
- ☐ The applicable preference point system for this tender is the **90/10** preference point system.
- ☐ Either the **90/10 or 80/20** preference point system will be applicable in this tender. The lowest/ highest acceptable tender will be used to determine the accurate system once tenders are received.

1.3 Points for this tender shall be awarded for:

1.3.1 Price; and

1.3.2 Municipal Objectives

1.4 The maximum points for this tender are allocated as follows:

CHOOSE APPLICABLE PREFERENCE POINT SCORING SYSTEM	☐ 80/20	☒ 90/10
PRICE	80	90
MUNICIPAL OBJECTIVES	20	10
Total points for Price and Specific Goals	100	100

1.5 Breakdown Allocation of Specific Goals Points

- 1.5.1 For Procurement transactions with rand value greater than R2 000.00 and up to R1 Million (Inclusive of all applicable taxes), the specific goals as listed in table 1 below are applicable.

PART T2: RETURNABLE DOCUMENTS
 BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

All Acquisitions

Table 1

Serial No	Specific Goals	Preference Points allocated out of 20	Documentation to be submitted by bidders to validate their claim for points
1.	An EME or QSE which is at least 51% owned by black people	10	• ID Copy Or • SANAS Accredited BBBEE Certificate or sworn affidavit where applicable Or • CSD Report Or • CIPC (company registration)
2.	Located in a specific Local Municipality or District Municipality or Metro or Province area for work to be done or services to be rendered in that area	2	• ID Copy (Mandatory) • Office Municipal Rates Statement Or • Permission To Occupy from local chief in case of rural areas (PTO) Or • Lease Agreement
3.	An EME or QSE which is at least 51% owned by women	4	• ID Copy Or • CSD Report Or • CIPC (company registration)
4.	An EME or QSE which is at least 51% owned by people with disability	2	• ID Copy (Mandatory) Or • Medical Certificate Or • South African Social Security Agency (SASSA) registration Or • National Council for Persons with Physical Disability in South Africa registration (NCPDPSA) Or • CSD Report Or • CIPC (company registration)
5.	An EME or QSE which is at least 51% owned by youth .	2	• ID Copy Or • CSD Report Or • CIPC (company registration)

1.5.2 For procurement transactions with rand value greater than R1 Million and up to R50 Million (Inclusive of all applicable taxes) the specific goals as listed in table 2 below are applicable:

All Acquisitions

Table 2

Serial No	Specific Goals	Preference Points allocated out of 20	Documentation to be submitted by bidders to validate their claim for points
1.	An EME or QSE or any entity which is at least 51% owned by Historically Disadvantaged Individuals (HDI)	10	• ID Copy Or • SANAS Accredited BBBEE Certificate or sworn affidavit where applicable Or • CSD Report Or • CIPC (company registration)
2.	Located in a specific Local Municipality or District Municipality or Metro or Province area for work to be done or services to be rendered in that area	2	• ID Copy (Mandatory) Or • Office Municipal Rates Statement Or • Permission To Occupy from local chief in case of rural areas (PTO) Or • Lease Agreement
3.	An EME or QSE or any entity which is at least 51% owned by women	4	• ID Copy Or • CSD Report Or • CIPC (company registration)

PART T2: RETURNABLE DOCUMENTS
 BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

4.	An EME or QSE or any entity which is at least 51% owned by people with disability	2	• ID Copy (Mandatory) Or • Medical Certificate Or • South African Social Security Agency (SASSA) registration Or • National Council for Persons with Physical Disability in South Africa registration (NCPDPSA) Or • CSD Report Or • CIPC (company registration)
5.	An EME or QSE or any entity which is at least 51% owned by youth .	2	• ID Copy Or • CSD Report Or • CIPC (company registration)

1.5.3 For procurement transactions with rand value greater than R50 Million (Inclusive of all applicable taxes) the specific goals as listed in table 3 below are applicable

All Acquisitions

Table 3

Serial No	Specific Goals	Preference Points allocated out of 10	Documentation to be submitted by bidders to validate their claim for points
1.	An EME or QSE or any entity which is at least 51% owned by Historically Disadvantaged Individuals (HDI)	4	• ID Copy Or • SANAS Accredited BBBEE Certificate or sworn affidavit where applicable Or • CSD Report Or • CIPC (company registration)
2.	Located in a specific Local Municipality or District Municipality or Metro or Province area for work to be done or services to be rendered in that area	2	• ID Copy (Mandatory) Or • Office Municipal Rates Statement Or • Permission To Occupy from local chief in case of rural areas (PTO) Or • Lease Agreement
3.	An EME or QSE or any entity which is at least 51% owned by women	2	• ID Copy • CSD Report Or • CIPC (company registration)
4.	An EME or QSE or any entity which is at least 51% owned by people with disability OR An EME or QSE or any entity which is at least 51% owned by youth .	2	• ID Copy (Mandatory) Or • Medical Certificate Or • South African Social Security Agency (SASSA) registration Or • National Council for Persons with Physical Disability in South Africa registration (NCPDPSA) • ID Copy • CSD Report Or • CIPC (company registration)

1.6 Failure on the part of the tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals, if the service provider/ tenderer did not submit proof or documentation required to claim for specific goals will be interpreted to mean that preference points for specific goals are not claimed.

1.7 The organ of state reserves the right to require of a service provider/tenderer, either before a tender is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the organ of state.

2. DEFINITIONS

- (a) **“tender”** means a written offer in the form determined by an organ of state in response to an invitation to provide goods or services through price quotations, competitive tendering process or any other method envisaged in legislation;
- (b) **“price”** means an amount of money tendered for goods or services, and includes all applicable taxes less all unconditional discounts;
- (c) **“rand value”** means the total estimated value of a contract in Rand, calculated at the time of bid invitation, and includes all applicable taxes;
- (d) **“tender for income-generating contracts”** means a written offer in the form determined by an organ of state in response to an invitation for the origination of income-generating contracts through any method envisaged in legislation that will result in a legal agreement between the organ of state and a third party that produces revenue for the organ of state, and includes, but is not limited to, leasing and disposal of assets and concession contracts, excluding direct sales and disposal of assets through public auctions; and
- (e) **“the Act”** means the Preferential Procurement Policy Framework Act, 2000 (Act No. 5 of 2000).

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

3.1.1. 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
$P_s = 80 \left(1 - \frac{P_t - P_{min}}{P_{min}} \right)$	or	$P_s = 90 \left(1 - \frac{P_t - P_{min}}{P_{min}} \right)$

Where:

P_s = Points scored for price of tender under consideration

P_t = Price of tender under consideration

P_{min} = Price of lowest acceptable tender

3.2. FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME GENERATING PROCUREMENT

3.2.1. POINTS AWARDED FOR PRICE

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

80/20	or	90/10
$P_s = 80 \left(1 + \frac{P_t - P_{max}}{P_{max}} \right)$	or	$P_s = 90 \left(1 + \frac{P_t - P_{max}}{P_{max}} \right)$

PART T2: RETURNABLE DOCUMENTS
BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

Where:

- Ps = Points scored for price of tender under consideration
Pt = Price of tender under consideration
Pmax = Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

- 4.1. In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in table 1,2 and 3 above as may be supported by proof/ documentation stated in the conditions of this tender:
- 4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—
- (a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or
 - (b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,
- then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

Table 1: Specific goals for the tender and points claimed are indicated per the table below.

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.

Note to tenderers: The tenderer must indicate how they claim points for each preference point system.)

The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system) (To be completed by the organ of state)	Number of points allocated (80/20 system) (To be completed by the organ of state)	Number of points claimed (90/10 system) (To be completed by the tenderer)	Number of points claimed (80/20 system) (To be completed by the tenderer)
1. An EME or QSE or any entity which is at least 51% owned by Historically Disadvantaged Individuals (HDI)	4	10		
2. Located in a specific Local Municipality or District Municipality or Metro or Province area for work to be done or services to be rendered in that area	2	2		
3. An EME or QSE or any entity which is at least 51% owned by women	2	4		
4. An EME or QSE or any entity which is at least 51% owned by people with disability or	2	2		
5. An EME or QSE or any entity which is at least 51% owned by youth.* (only one specific goal is applicable between specific goal number 4 and specific goal number 5 under 90/10 Preference Point System)	2	2		

Note: *in respect of the 90/10 point system a selection of either disability or youth may be made with an allocation of 2 points for either of them.

5. DECLARATION WITH REGARD TO COMPANY/FIRM

5.1. Name of company/firm.....

5.2. Company registration number:

5.3. TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
- ☐ One-person business/sole propriety
- ☐ Close corporation
- ☐ Public Company
- ☐ Personal Liability Company
- ☐ (Pty) Limited
- ☐ Non-Profit Company
- ☐ State Owned Company

[TICK APPLICABLE BOX]

5.4. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I 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 paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;
- iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –
 - (a) disqualify the person from the tendering 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) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted 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, if deemed necessary.

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..... SIGNATURE(S) OF TENDERER(S) SURNAME AND NAME: DATE: ADDRESS:

8. SUB-CONTRACTING

8.1 Will any portion of the contract be sub-contracted?

YES		NO	

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?

YES		NO	

9. DECLARATION WITH REGARD TO COMPANY/FIRM

9.1 Name of firm:

9.2 VAT registration number

9.3 Company Registration number

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9.4 **TYPE OF FIRM** (Tick Applicable Box)

☐	Partnership/Joint venture / consortium
☐	One Person business / sole propriety
☐	Close Corporation
☐	Company
☐	(Pty) Ltd
☐	Other: Specify

9.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

9.6 MUNICIPAL INFORMATION

Municipality where business is situated

Registered Account Number

Stand Number

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-BBEE status level of contribution indicated in paragraph 7 of the foregoing certificate, qualifies the company / firm for the preference(s) shown and I / we acknowledge that:

The information furnished is true and correct;

- (ii) The preference points claimed are in accordance with the 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;

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- (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) restricted 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)

ADDRESS:

FORM A3.2: B-BBEE Compulsory Declaration (In case of a JV)

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

Section 1: Enterprise Details

Name of enterprise:	
Contact person:	
Email:	
Telephone:	
Cell no	
Fax:	
Physical address	
Postal address	

Section 2: Particulars of companies and close corporations

Company / Close Corporation registration number	

Section 3: SARS Information

Tax reference number	
VAT registration number:	<i>State Not Registered if not registered for VAT</i>

Section 4: CIDB registration number

CIDB Registration number (if applicable)	

Section 5: National Treasury Central Supplier Database

Supplier number

Unique registration reference number

Section 6: Particulars of principals

principal: means a natural person who is a partner in a partnership, a sole proprietor, a director of a company established in terms of the Companies Act of 2008 (Act No. 71 of 2008) or a member of a close corporation registered in terms of the Close Corporation Act, 1984, (Act No. 69 of 1984).

Full name of principal	Identity Number	Personal tax reference number
Attach separate page if necessary		

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Section 7: Record in the service of the state

Indicate by marking the relevant boxes with a cross, if any principal is currently or has been within the last 12 months in the service of any of the following:

☐ a member of any municipal council ☐ a member of any provincial legislature ☐ a member of the National Assembly or the National Council of Province ☐ a member of the board of directors of any municipal entity ☐ an official of any municipality or municipal entity	☐ an employee of any department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act of 1999 (Act No. 1 of 1999) ☐ a member of an accounting authority of any national or provincial public entity ☐ an employee of Parliament or a provincial legislature

If any of the above boxes are marked, disclose the following:

Name of principal	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*insert separate page if necessary

Section 8: Record of family member in the service of the state

family member: a person's spouse, whether in a marriage or in a customary union according to indigenous law, domestic partner in a civil union, or child, parent, brother, sister, whether such a relationship results from birth, marriage or adoption

Indicate by marking the relevant boxes with a cross, if any family member of a principal as defined in section 5 is currently or has been within the last 12 months been in the service of any of the following:

☐ a member of any municipal council ☐ a member of any provincial legislature ☐ a member of the National Assembly or the National Council of Province ☐ a member of the board of directors of any municipal entity ☐ an official of any municipality or municipal entity	☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999) ☐ a member of an accounting authority of any national or provincial public entity ☐ an employee of Parliament or a provincial legislature

Name of family member	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		Current	Within last 12 months

*insert separate page if necessary

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Section 9: Record of termination of previous contracts with an organ of state

Was any contract between the tendering entity including any of its joint venture partners terminated during the past 5 years for reasons other than the employer no longer requiring such works or the employer failing to make payment in terms of the contract.

☐ Yes ☐ No (Tick appropriate box)

If yes, provide particulars (insert separate page if necessary)

Section 10: Declaration

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the tendering entity confirms that the contents of this Declaration are within my personal knowledge, and save where stated otherwise in an attachment hereto, are to the best of my belief both true and correct, and:

- i) neither the name of the tendering entity or any of its principals appears on:
 - a) the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004 (Act No. 12 of 2004)
 - b) National Treasury's Database of Restricted Suppliers (see www.treasury.gov.za)
- ii) neither the tendering entity or any of its principals has within the last five years been convicted of fraud or corruption by a court of law (including a court outside of the Republic of South Africa);
- iii) any principal who is presently employed by the state has the necessary permission to undertake remunerative work outside such employment (attach permission to this declaration);
- iv) the tendering entity is not associated, linked or involved with any other tendering entities submitting tender offers
- v) has not engaged in any prohibited restrictive horizontal practices including consultation, communication, agreement, or arrangement with any competing or potential tendering entity regarding prices, geographical areas in which goods and services will be rendered, approaches to determining prices or pricing parameters, intentions to submit a tender or not, the content of the submission (specification, timing, conditions of contract etc) or intention to not win a tender;
- vi) has no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
- vii) neither the tenderer or any of its principals owes municipal rates and taxes or municipal service charges to any municipality or a municipal entity and are not in arrears for more than 3 months;
- viii) SARS may, on an on-going basis during the term of the contract, disclose the tenderer's tax compliance status to the Employer and when called upon to do so, obtain the written consent of any subcontractors who are subcontracted to execute a portion of the contract that is entered into in excess of the threshold prescribed by the National Treasury, for SARS to do likewise.

Signed _____ Date _____

Name _____ Position _____

Enterprise name _____

NOTE 1 The Standard Conditions of Tender contained in SANS 10845-3 prohibits anticompetitive practices (clause 3.1) and requires that tenderers avoid conflicts of interest, only submit a tender offer if the tenderer or any of his principals is not under any restriction to do business with employer (4.1.1) and submit only one tender either as a single tendering entity or as a member in a joint venture (clause 4.13.1). Clause 5.7 also empowers the Employer to disqualify any tenderer who engages in fraudulent and corrupt practice. Clause 3.1 also requires tenderers to comply with all legal obligations.

NOTE 2: Section 30(1) of the Public Service Act, 1994, prohibits an employee (person who is employed in posts on the establishment of departments) from performing or engaging remunerative work outside his or her employment in the relevant department, except with the written permission of the executive authority of the department. When in operation, Section 8(2) of the Public Administration Management Act, 2014, will prohibit an employee of the public administration (i.e. organs of state and all national departments, national government components listed in Part A of Schedule 3 to the Public Service Act, provincial departments including the office of the premier listed in Schedule 1 of the Public Service Act and provincial departments listed in schedule 2 of the Public Service Act, and provincial government components listed in Part B of schedule 3 of the Public Service Act) or persons contracted to executive authorities in accordance with the provisions of section 12A of the Public

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Service Act of 1994 or persons performing similar functions in organs of state from conducting business with the State or to be a director of a public or private company conducting business with the State. The offence for doing so is a fine or imprisonment for a period not exceeding 5 years or both. It is also a serious misconduct which may result in the termination of employment by the employer.

NOTE 3: Regulation 44 of Supply Chain Management regulations issued in terms of the Municipal Finance Management Act of 2003 requires that organs of state and municipal entities not award a contract to a person who is the service of the state, a director, manager or principal shareholder in the service of the state or who has been in the service of the state in the previous twelve months.

NOTE: 4: Regulation 45 of Supply Chain Management regulations requires a municipality or municipal entity to disclose in the notes to the annual statements particulars of any award made to a close family member in the service of the state.

NOTE: 5 Corrupt activities which give rise to an offence in terms of the Prevention and Combating of Corrupt Activities Act of 2004) include improperly influencing in any way the procurement of any contract, the fixing of the price, consideration or other moneys stipulated or otherwise provided for in any contract and the manipulating by any means of the award of a tender.

NOTE: 6 Section 4 of the Competition Act of 1998 prohibits restrictive horizontal practice including agreements between parties in a horizontal relationship which have the effect of substantially preventing or lessening competition, directly or indirectly fixing prices or dividing markets or constitute collusive tendering. Section 5 also prohibits restrictive vertical practices. Any restrictive practices that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties.

FORM A4: COMPULSORY ENTERPRISE QUESTIONNAIRE

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

Section 1: Name of enterprise:

Section 2: VAT registration number, if any:

Section 3: CIDB registration number, if any:

Section 4: Particulars of sole proprietors and partners in partnerships

Name*	Identity number*	Personal income tax number*

* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners

Section 5: Particulars of companies and close corporations

Company registration number

Close corporation number

Tax reference number

Section 6: Record of service of the state

Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:

☐ a member of any municipal council	☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)
☐ a member of any provincial legislature	☐ a member of an accounting authority of any national or provincial public entity
☐ a member of the National Assembly or the National Council of Province	☐ an employee of Parliament or a provincial legislature
☐ a member of the board of directors of any municipal entity	
☐ an official of any municipality or municipal entity	

If any of the above boxes are marked, disclose the following:

Name of sole proprietor, partner, director, manager, principal shareholder or stakeholder	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		current	Within last 12 months

*insert separate page if necessary

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Section 7: Record of spouses, children and parents in the service of the state

Indicate by marking the relevant boxes with a cross, if any spouse, child or parent of a sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months been in the service of any of the following:

☐ a member of any municipal council ☐ a member of any provincial legislature ☐ a member of the National Assembly or the National Council of Province ☐ a member of the board of directors of any municipal entity ☐ an official of any municipality or municipal entity	☐ an employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999) ☐ a member of an accounting authority of any national or provincial public entity ☐ an employee of Parliament or a provincial legislature

Name of spouse, child or parent	Name of institution, public office, board or organ of state and position held	Status of service (tick appropriate column)	
		current	Within last 12 months

*insert separate page if necessary

The undersigned, who warrants that he/she is duly authorised to do so on behalf of the enterprise:

- i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
- ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004;
- iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last five years been convicted of fraud or corruption;
- iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest;
- iv) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

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FORM A5: Certificate of Attendance at a tender site meeting

I / We acknowledge that the tender briefing was attended by a company representative able to relay the presentation of the works and/ or matters incidental to doing the works in the tender document in order for me/ us to take account of everything necessary when compiling our rates and prices included in the tender.

I/we acknowledge that the attendance register will be used to confirm our company’s presence and if found to be absent, will lead to our tender being disqualified.

Name: Signature:

Capacity: Date and Time:

**FORM A6: Certificate of Authority of Joint Ventures/ Close corporations/
Partnership/ Company/ Sole proprietor (Certified Copies of the
Identity Documents in the Case of sole proprietor)**

Indicate the status of the Tenderer by ticking the appropriate box hereunder. The Tenderer must complete the certificate set out below for the relevant category.

(I) COMPANY	(II) CLOSE CORPORATION	(III) PARTNERSHIP	(IV) JOINT VENTURE	(V) SOLE PROPRIETOR

(I) CERTIFICATE OF COMPANY

I, ..., chairperson of the Board of Directors of
....., hereby confirm that by resolution of the Board (copy
attached) taken on 20....., Mr/Ms,
acting in the capacity of....., was
authorized to sign all documents in connection with the tender for Contract No. ALMT14/2025 and
any contract resulting from it on behalf of the company.

Chairman:

As Witnesses: 1.....

2.....

Date:

(II) CERTIFICATE FOR CLOSE CORPORATION

We, the undersigned, being the key members in the business trading as,
..... hereby authorize Mr/Ms, acting
in the capacity of....., to sign all documents in
connection with the tender for Contract No. ALMT14/2025 and any contract resulting from it on our
behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note : This certificate is to be completed and signed by all of the key members upon whom rests the direction of the affairs of the Close Corporation as a whole.

(III) CERTIFICATE FOR PARTNERSHIP

We, the undersigned, being the key partners in the business trading as,
....., hereby authorize Mr/Ms,
acting in the capacity of, to sign all documents in connection
with the tender for Contract No. ALMT14/2025 and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

Note : This certificate is to be completed and signed by all of the key partners upon whom rests the direction of the affairs of the Partnership as a whole.

FORM A7: Registration Certificate of an Entity

Important note to Tenderer:

- 1. Registration Certificates for Companies, Close Corporations and Partnerships, and ID documents for Sole Proprietors, must be attached here. In the case of a Joint Venture, a copy of a duly signed Joint Venture Agreement must be included***
- 2. Bank letter to be attached here. To be specific to this project and not older than 30 days. The letter shall state the tenderers ability to finance working capital requirements before the first claim is to be paid by the client.***

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FORM A8: Schedule of the Tenderer's Experience

EMPLOYER: CONTACT PERSON AND TELEPHONE NUMBER	CONSULTING ENGINEER: CONTACT PERSON AND TELEPHONE NUMBER	NATURE OF WORK	VALUE OF WORK (inclusive of VAT)	DATE COMPLETED OR EXPECTED TO BE COMPLETED

Signed..... Date

Name Position.....

Tenderer

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FORM A9.1: Schedule Key Personnel

In terms of the Project Specification and the Conditions of Tender, unskilled workers may only be brought in from outside the local community if such personnel are not available locally.

The Tenderer shall list below the personnel which he intends to utilize on the Works, including key personnel which may have to be brought in from outside if not available locally.

CATEGORY OF EMPLOYEE	NUMBER OF PERSONS					
	KEY PERSONNEL, PART OF THE CONTRACTOR'S ORGANISATION		KEY PERSONNEL TO BE IMPORTED IF NOT AVAILABLE LOCALLY		UNSKILLED PERSONNEL TO BE RECRUITED FROM LOCAL COMMUNITY	
	HDI	NON-HDI	HDI	NON-HDI	HDI	NON-HDI
Site Agent, Project Managers						
Foremen, Quality Control and Safety Personnel						
Technicians, Surveyors, etc						
Artisans and other Skilled workers						
Plant Operators						
Unskilled Workers						
Others:						
.....						
.....						
.....						

Signed

Date

Name

Position

Tenderer

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FORM A9.2: Format of Curriculum Vitae of Key Personnel

Provide separate forms for each position listed in the Form: Key Personnel

Project Manager

1. PERSONAL PARTICULARS		
Name:		
Date and Place of Birth:		
2. QUALIFICATIONS		
Description and Year Obtained		
3. PROFESSIONAL REGISTRATION		
Description and Registration Number		
4. SKILLS		
5. CURRENT EMPLOYER		
Company		
Position		
6. RECENT ASSIGNMENT (LAST 10 TO 15 YRS)		
Project Start and End Date	Project Description (listing all key relevant components)	References
		Name:
		Position:
		Contact Number:
		E-mail:

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Certification:

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

.....
Signature of person named in the schedule

.....
Date

FORM A10: Schedule of Proposed Subcontractors

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

Tenderers or contractors must submit proof of subcontracting arrangement between the main tenderer and the subcontractor.

Tenders that do not meet subcontracting requirements are considered as being not acceptable tenders and must be disqualified and may not be considered for further evaluation or award.

Name and address of proposed Subcontractor	Nature and extent of work	Previous experience with Subcontractor.

Signed _____ Date _____

Name _____ Position _____

Tenderer _____

FORM A11: Schedule of Plant and Equipment

The following are lists of major items of relevant equipment that I / we presently own or lease and will have available for this contract or will acquire or hire for this contract if my / our tender is accepted.

(a) Details of major equipment that is owned by and immediately available for this contract.

Quantity	Description, size, capacity, etc.
	Excavator (minimum 20 t, tracked) Concrete Mixer Truck / Batching Plant or Concrete Mixer Crane Other:

Attach additional pages if more space is required.

(b) Details of major equipment that will be hired or acquired for this contract if my / our tender is acceptable.

Quantity	Description, size, capacity, etc.
	Excavator (minimum 20 t, tracked) Concrete Mixer Truck / Batching Plant or Concrete Mixer Crane Other:

Attach additional pages if more space is required.

Signed Date

Name Position

Tenderer.....

FORM A12: Certificate of Registration with CIDB

The tenderer shall provide a printed copy of the Active Contractor's Listing off the CIDB website. (www.cidb.org.za). Tenderers whose CIDB registration expires within 21 days after close of tender should attach proof of their application for re-registration (refer to Tender Data Clause F.2.1). In the case of a Joint Venture, a printed copy of the Active Contractor's Listing must be provided for each member of the Joint Venture.

Name of Contractor:

Contractor Grading Designation:.....

CIDB Contractor Registration Number:

Expiry Date:

**FORM A13: DECLARATION CERTIFICATE FOR LOCAL PRODUCTION AND
CONTENT FOR DESIGNATED SECTORS**

This Municipal Bidding Document (MBD) 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, 2011 and 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, 2011 (Regulation 9) makes provision for the promotion of local production and content.
- 1.2. Regulation 9.(1) prescribes that in the case of designated sectors, where in the award of bids local production and content is of critical importance, such bids must be advertised with the specific bidding condition that only locally produced goods, services or works or locally manufactured goods, with a stipulated minimum threshold for local production and content will be considered.
- 1.3. Where necessary, for bids 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 the South African Reserve Bank (SARB) at 12:00 on the date of advertisement of the bid as required in paragraph 4.1 below.

The SABS approved technical specification number SATS 1286:2011 is accessible on [http://www.thedti.gov.za/industrial development/ip.jsp](http://www.thedti.gov.za/industrial%20development/ip.jsp) at no cost.

- 1.6. A bid may be disqualified if –
 - (a) this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation; and
 - (b) the bidder fails to declare that the Local Content Declaration Templates (Annex C, D and E) have been audited and certified as correct.

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2. Definitions

- 2.1. **“bid”** includes written price quotations, advertised competitive bids or proposals;
- 2.2. **“bid price”** price offered by the bidder, excluding value added tax (VAT);
- 2.3. **“contract”** means the agreement that results from the acceptance of a bid by an organ of state;
- 2.4. **“designated sector”** means a sector, sub-sector or industry that has been designated by the Department of Trade and Industry in line with national development and industrial policies for local production, where only locally produced services, works or goods or locally manufactured goods meet the stipulated minimum threshold for local production and content;
- 2.5. **“duly sign”** means a Declaration Certificate for Local Content that has been signed by the 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).
- 2.6. **“imported content”** means that portion of the bid price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or its subcontractors) and which costs are inclusive of the costs abroad (this includes labour and intellectual property costs), plus freight and other direct importation costs, such as landing costs, dock duties, import duty, sales duty or other similar tax or duty at the South African port of entry;
- 2.7. **“local content”** means that portion of the bid price which is not included in the imported content, provided that local manufacture does take place;
- 2.8. **“stipulated minimum threshold”** means that portion of local production and content as determined by the Department of Trade and Industry; and
- 2.9. **“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.

3. 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:

<u>Description of services, works or goods</u>	<u>Stipulated minimum threshold</u>
_____	_____ %
_____	_____ %
_____	_____ %

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

YES		NO	

- 4.1 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 the SARB for the specific currency at 12:00 on the date of advertisement of the bid.
 The relevant rates of exchange information is accessible on **www.reservebank.co.za**.

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

PART T2: RETURNABLE DOCUMENTS
 BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

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

5. Were the Local Content Declaration Templates (Annex C, D and E) audited and certified as correct?
 (Tick applicable box)

YES		NO	

- 5.1. If yes, provide the following particulars:

- (a) Full name of auditor:
- (b) Practice number:
- (c) Telephone and cell number:
- (d) Email address:

(Documentary proof regarding the declaration will, when required, be submitted to the satisfaction of the Accounting Officer / Accounting Authority)

6. 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 Accounting Officer / Accounting Authority 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 Municipality / Municipal Entity):

.....

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/industrialdevelopment/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.

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

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
 - (ii) the declaration templates have been audited and certified to be correct.

(c) The local content percentages (%) indicated below has been calculated using the formula given in clause 3 of SATS 1286:2011, the rates of exchange indicated in paragraph 4.1 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 4.1 above and the information contained in Declaration D and E.

(d) I accept that the Procurement Authority / Municipality /Municipal Entity 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 / Municipal / Municipal Entity imposing any or all of the remedies as provided for in Regulation 13 of the Preferential Procurement Regulations, 2011 promulgated under the Preferential Policy Framework Act (PPPFA), 2000 (Act No. 5 of 2000).

SIGNATURE: _____

DATE: _____

WITNESS No. 1 _____

DATE: _____

WITNESS No. 2 _____

DATE: _____

FORM A14: Competence Achievement Schedules

Functionality Points will be allocated as follows (110 points maximum). Refer to Tender Data clause F.3.11:

TABLE A1: EXPERIENCE, REPUTATION AND REFERENCES

	TARGETED GOALS Name reference with contact details	TENDERED GOAL	POINTS CLAIMED BY TENDERER	ALLOCATED POINTS
1		10		
2				
3		10		
4				
5				
6		10		
7				
8				
9				
	SUB-TOTAL: Reputation and References	30		

All information provided should have traceable references.

Appointment letters and Completion Certificates from previous project Clients must be attached.

TABLE A2: ORGANIZATIONAL STRUCTURE

	TARGETED GOALS	TENDERED GOAL	POINTS CLAIMED BY TENDERER	ALLOCATED POINTS
1	Project Organogram	4		
2	Experience of Key Personnel	56		
	SUB-TOTAL: Financial references	60		

TABLE A3: FINANCIAL MANAGEMENT PLAN

	TARGETED GOALS	TENDERED GOAL	POINTS CLAIMED BY TENDERER	ALLOCATED POINTS
1	Comprehensive Financial Submission:	10		
	SUB-TOTAL: Financial Management	10		

PART T2: RETURNABLE DOCUMENTS
 BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

TABLE A4: QUALITY ASSURANCE AND CONTROL PROCEDURE

	TARGETED GOALS	TENDERED GOAL	POINTS CLAIMED BY TENDERER	ALLOCATED POINTS
1	ISO 9001:2015 Certification	10		
	SUB-TOTAL: Quality Assurance	10		

Note: Proof of ownership or letter of intent from a hiring company must be attached.

TABLE A5: SUPPLY CHAIN POLICY USING 90/10 PREFERENCE POINT SYSTEM

		Maximum Points to be Allocated	Minimum required points	Points Claimed by Tenderer	Allocated Points
Functionality and Quality (60 Points)	Table A1	30	15		
	Table A2	60	44		
	Table A3	10	5		
	Table A4	10	5		
	Sub Total	110	69		

The minimum number of evaluation points for Functionality & Quality is 69 points.

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

STAGE 1 : SCORING QUALITY

TABLE A1: EXPERIENCE, REPUTATION AND REFERENCES

The functionality assessment shall be based on the tenderer's demonstrated experience in the successful completion of projects of a similar nature and complexity. Experience shall be evaluated under the following categories:

1. **Earth/Concrete and Rockfill Dams and Weir** (Construction and completion of Category II Dams as minimum, Earth Dams/Rockfill Dams, Weir ≥5m in height and Intake Towers) = **10 points shall awarded based on successful completion of Two Category II dams or more**
2. **Bulk Water Services Infrastructure systems** (Construction and completion of a combination of bulk water projects.) = **10 points shall be awarded based on the successful completion of Three or more completed bulk water Services projects to the value of 300 million per project**
3. **Roads and Bridges** (Construction and completion of rural surfaced roads, including bridges and culverts) = **10 points shall be awarded based on successful of Five or more projects valued at R50 million per project**

Tenderers must achieve a minimum functionality score of 15 out of 30 points to be considered responsive and to proceed to the next stage of evaluation.

In addition, tenderers must score at least 5 points in Category 1 (Earthfill/Concrete and Rockfill Dams and Weirs), as this category represents the core scope of the Works.

Tenderers who fail to achieve the minimum qualifying score shall be deemed non-responsive and shall not be considered further.

TABLE A2: ORGANIZATIONAL STRUCTURE

The Tenderer shall provide suitably qualified and experienced key personnel for the duration of the Contract and shall submit detailed Curriculum Vitae (CVs), qualifications, professional registrations, and proof of experience for each proposed resource. The Tenderer shall also submit a project organogram clearly indicating reporting lines, responsibilities, and communication channels for the proposed project team.

1. Points shall be awarded for each required key person based on compliance with the minimum qualification, professional registration, and relevant project experience requirements specified in the tender document.
2. A proposed key person who fully satisfies or exceeds the prescribed requirements for the position shall be awarded the maximum points allocated to that position.
3. A proposed key person who partially satisfies the prescribed requirements may be awarded reduced points in accordance with the detailed scoring criteria provided for the position.
4. A proposed key person who does not meet the minimum requirements for the position shall score zero (0) points for that position.
5. The project organogram shall be evaluated on the completeness of the proposed project structure, clarity of reporting relationships, allocation of responsibilities, adequacy of resources, and suitability for the successful execution of the Works.
6. A comprehensive, project-specific and well-defined organogram demonstrating clear lines of authority and communication shall be awarded four (4) points.
7. Tenderers must achieve a minimum score of 44 out of 60 points under Organisational Structure and Key Personnel to be considered responsive for this functionality criterion.

PART T2: RETURNABLE DOCUMENTS
 BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

TABLE A3: FINANCIAL MANAGEMENT PLAN
The Tenderer shall demonstrate adequate financial capacity to successfully execute the Works by submitting the following: 1. Audited Annual Financial Statements for the most recent three (3) financial years, including the Income Statement and Balance Sheet; 2. Proof of an average annual turnover of not less than R300 million over the preceding three (3) financial years; 3. Proof of available capital, cash reserves, investments, or access to funding of not less than R20 million; 4. Evidence that the minimum financial ratios specified in the Tender Data have been achieved; 5. Clear proof of financial resources available for the execution of the Works; 6. A bank rating of C or better issued by a recognised financial institution; 7. Proof of access to performance security in the form of a guarantee facility or a Letter of Intent from an approved financial institution or insurer; 8. An independent confirmation letter from the Tenderer's Auditor verifying the financial ratios and financial standing of the Tenderer. A maximum of 10 points and a minimum of 5 points are obtainable to proceed with further evaluation. Bidders who fail to achieve the minimum stipulated points shall be deemed non-responsive.
TABLE A4: QUALITY ASSURANCE AND CONTROL PROCEDURE
The Tenderer shall submit a valid ISO 9001:2015 Quality Management System certification issued by an accredited certification body. Tenderers submitting a valid ISO 9001:2015 certificate shall be awarded 10 points. Tenderers who do not possess a valid ISO 9001:2015 certificate but submit an established in-house Quality Management Plan shall be awarded 5 points. Tenderers who fail to submit either a valid ISO 9001:2015 certificate or an in-house Quality Management Plan shall be awarded 0 points.

STAGE 2: SCORING QUALITY

The purpose of **Stage 2** is to verify the accuracy and authenticity of the company experience submitted by the tenderer during **Stage 1**. The evaluation conducted during Stage 1 will not be rescored; however, the Employer reserves the right to verify all information submitted and to confirm that the awarded scores are justified.

As part of the verification process, the Employer, Evaluation Committee, and/or its appointed representatives will conduct site visits to the nominated reference projects submitted by the tenderer. Such site visits will be undertaken to verify the existence of the projects, assess the quality and standard of the completed works, confirm the tenderer's involvement in the projects, and determine the similarity of the projects to the Works under this Contract in terms of scope, complexity, and technical requirements.

The tenderer shall provide any information reasonably required by the Employer to undertake the verification process.

Verification will include but not limited to

- (a) Confirmation of the existence of the referenced projects;
- (b) Verification of the tenderer's role and level of participation in the referenced projects;
- (c) Confirmation of project values, scope of works, dates of completion, and contractual responsibilities;
- (d) Confirmation that the projects were successfully completed and commissioned;
- (e) Verification of the quality and standard of workmanship achieved on the referenced projects;

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

(f) Assessment of the similarity of the referenced projects to the Works under this Contract in terms of size, complexity, technical requirements, dam construction, weir construction, bulk pipelines, pump stations, mechanical and electrical installations, or other relevant infrastructure;

(g) Client reference checks with employers, engineers, project managers, or other relevant stakeholders;

The Employer may contact any client, consultant, employer, or reference provided by the tenderer and may request additional information, supporting documentation, completion certificates, photographs, or other evidence necessary to verify the submitted experience.

Should any information submitted by a tenderer be found to be materially incorrect, misleading, unverifiable, or inconsistent with the information obtained during the verification process, the Employer reserves the right to adjust the functionality score, reject the relevant project from consideration, or disqualify the tenderer from further evaluation.

Following completion of Stage 2, only tenderers whose experience and reference projects are successfully verified to the satisfaction of the Employer will proceed to the evaluation of price and specific goals and will be invited to the opening of financial proposals. Financial proposals of tenderers who fail the experience verification stage will not be opened and will be returned to the tenderer(s) unopened.

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
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FORM A15: Registration on National Treasury Central Supplier Database

The tenderer shall provide a printed copy of the Active Supplier Listing on the National Treasury Central Supplier Database. (www.treasury.gov.za). Tenderers who are not registered on the Central Supplier Database should attach proof of their application for registration. In the case of a Joint Venture, a printed copy of the Active Supplier Listing must be provided for each member of the Joint Venture.

Name of Contractor:

Central Supplier Database Supplier Number:

Expiry Date:

FORM A16: Form of Intent to Provide a Performance Guarantee

The Tenderer must attach hereto a letter from the bank or institution with whom he has made the necessary arrangements, to the effect that the said bank or institution will be prepared to provide the required performance guarantee when asked to do so.

PRO-FORMA FOR A PERFORMANCE GUARANTEE

PERFORMANCE GUARANTEE

Employer: (Name and Address)

.....

Bid No:

(Contract title)

WHEREAS

.....

(hereinafter referred to as "the Employer") entered into, a Contract with

.....

.

(hereinafter called "the Contactor") on the day of
20.....

for the construction of (Contract Title)

.....

.

at

.....

AND WHEREAS it is provided by such Contract that the Contractor shall provide the Employer with security by way of a guarantee for the due and faithful fulfilment of such Contract by the Contractor;

AND WHEREAS (hereinafter referred to as "the Guarantor") Has/have at the request of the Contractor, agreed to give such guarantee;

NOW THEREFORE WE,

.....

Do hereby guarantee and bind ourselves jointly and severally as Guarantor and Co-Principal Debtors to the Employer under renunciation of the benefits of division and exclusion for the due and faithful performance by the Contractor of all the terms and conditions of the said Contract, subject to the following conditions:

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

1. The Employer shall, without reference and/or notice to us, have complete liberty of action to act in any manner authorized and/or contemplated by the terms of the said Contract, and/or to agree to any modifications, variations, alterations, directions or extensions of the Completion Date of the Works under the said Contract, and that its rights under this guarantee shall in no way be prejudiced nor our liability hereunder be affected by reason of any steps which the Employer may take under such Contract, or of any modification, variation, alterations of the Completion Date which the Employer may make, give, concede or agree to under the said Contract.
2. This guarantee shall be limited to the payment of a sum of money
3. The Employer shall be entitled, without reference to us, to release any guarantee held by it, and to give time to or compound or make any other arrangement with the Contractor. However, upon receipt by us of an authenticated copy of the Certificate of Completion in terms of the Contract, the amount of liability shall be reduced by 50%, which shall be in force until the issue of the Final Approval Certificate at expiry of the Defects Liability Period
4. This guarantee shall remain in full force and effect until the issue of the Certificate of Completion in terms of the Contract, unless we are advised in writing by the Employer before the issue of the said Certificate of his intention to institute claims, and the particulars thereof, in which event this guarantee shall remain in full force and effect until all such claims have been paid or liquidated.
5. Our total liability hereunder shall not exceed the sum of

.....
.....
.....(in words)

R (in figures)

(10 % of the tender sum) which amount I/we agree to hold at your disposal.

6. The Guarantor reserves the right to withdraw from this guarantee by depositing the Guaranteed Sum with the beneficiary, whereupon the Guarantor's liability hereunder shall cease.

I/We declare that I/we, on behalf of the Guarantor, waive the legal exceptions available to a guarantor and undertake to pay the said amount or such portion thereof as may be demanded, immediately on receipt of a written demand from you.

A certificate under your hand shall be sufficient and satisfactory evidence as to the amount of the Guarantor's liability for the purpose of enabling provisional sentence or any similar relief to be obtained against the Guarantor.

This guarantee is neither negotiable nor transferable, and must be surrendered to the Guarantor in the event of the full amount of the Guarantee being paid to the Employer.

PART T2: RETURNABLE DOCUMENTS
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 SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

7. I/We hereby choose our address for the serving of all notices for all purposes arising here
 from as

.....

IN WITNESS WHEREOF this guarantee has been executed by us at

on this day of 20.....

As witnesses:

1. Signature
2. Signature

Duly authorized to sign on behalf of (*Guarantor*).....

Address

.....

FORM A17: Tax Clearance Certificate

Tax Clearance Certificate obtained from SARS to be inserted here.

IMPORTANT NOTES:

1 The tenderer shall attach to this page an original current Tax Clearance certificate and VAT Registration certificate which is valid for the duration of the Tender offer validity period and which shall be obtained by the tenderer from the South African Revenue Service (SARS).

In the event of a joint venture, each member shall comply with the above requirement.

Where such certificates are no longer issued by SARS the tenderer shall complete the declaration below.

I, ... (name)
the undersigned in my capacity as (position)
on behalf of (name of company)
herewith grant consent that SARS may disclose to Chief Albert Luthuli Local Municipality our tax
compliance status. For this purpose, our unique security personal identification number (PIN) is
.....

Each party to a Consortium / Joint Venture / Subcontractors must complete a separate Tax Clearance Certificate.

Failure to submit a valid Tax Clearance Certificate ISSUED BY SARS WITH YOUR BID DOCUMENT AT THE TIME OF CLOSING will invalidate the tender.

PART T2: RETURNABLE DOCUMENTS
BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

(ST 5.1) March 1999

APPLICATION FORM FOR TAX CLEARANCE CERTIFICATE

(IN RESPECT OF TENDER)

1. NAME OF TAXPAYER/TENDERER:																					
2. TRADE NAME:																					
3. IDENTIFICATION No. (if applicable) :	<table border="1" style="width: 100%; height: 20px;"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																				
4. COMPANY/CLOSE CORPORATION REG No. :	<table border="1" style="width: 100%; height: 20px;"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																				
5. INCOME TAX REFERENCE No. :	<table border="1" style="width: 100%; height: 20px;"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																				
6. VAT REGISTRATION No. :	<table border="1" style="width: 100%; height: 20px;"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																				
7. PAYE EMPLOYERS REG No. (if applicable) :	<table border="1" style="width: 100%; height: 20px;"><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>																				
NB : Copy of the tender request must be attached to this application.																					
CONTACT PERSON REQUIRING TAX CLEARANCE CERTIFICATE:																					
SIGNATURE:																					
NAME :																					
TELEPHONE NUMBER :	CODE: NUMBER:																				
ADDRESS :																					
.....																					
DATE : 20...../...../.....																					
Please note that the Commissioner for the South African Revenue Service (SARS) will not exercise his discretionary powers in favour of any person with regard to any interest, penalties and/or additional tax leviable due to the late or underpayment of taxes, duties or levies or the rendition of returns by any person.																					
NAME OF PERSON RESPONSIBLE FOR CONTRACT :																					

NB: *This is a pro forma application form that has to be submitted to SARS to enable them to issue the required Tax Clearance Certificate. The valid Tax Clearance Certificate furnished by the Receiver of Revenue must be submitted with the tender (to be attached to the next page).*

TAX CLEARANCE CERTIFICATE

[Tax Clearance Certificate obtained from SARS to be attached here]

MBD 4

FORM A18: Declaration of Interest

1. No bid will be accepted from persons in the service of the state*.
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority and/or take an oath declaring his/her interest.

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

3.1 Full Name:

3.2 Identity Number:

3.3 Company Registration Number:

3.4 Tax Reference Number:

3.5 VAT Registration Number:

3.6 Are you presently in the service of the state* **YES / NO**

3.6.1 If so, furnish particulars.

.....

.....

3.7 Have you been in the service of the state for the past **YES / NO**
twelve months?

3.7.1 If so, furnish particulars.

.....

3.8 Do you, have any relationship (family, friend, other) with persons
in the service of the state and who may be involved with the
evaluation and or adjudication of this bid? **YES/NO**

PART T2: RETURNABLE DOCUMENTS
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SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

3.8.1 If so, furnish particulars.

.....
.....

3.9 Are you, aware of any relationship (family, friend, other) between
a bidder and any persons in the service of the state 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 any of the company's directors, managers, principle
shareholders or stakeholders in service of the state?

YES / NO

3.10.1 If so, furnish particulars.

.....
.....

3.11 Are any spouse, child or parent of the company's directors,
managers, principle shareholders or stakeholders in service
of the state?

YES / NO

3.11.1 If so, furnish particulars.

.....
.....

* MSCM Regulations: "in the service of the state" means to be –

(a) a member of –

- (i) any municipal council;
- (ii) any provincial legislature; or
- (iii) the national Assembly or the national Council of provinces;

(b) a member of the board of directors of any municipal entity;

(c) an official of any municipality or municipal entity;

(d) an employee of 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);

(e) a member of the accounting authority of any national or provincial public entity; or
an employee of Parliament or a provincial legislature.

FORM A19: Declaration FOR Procurement above R10 Million

For all procurement expected to exceed R10 million (all applicable taxes included), bidders must complete the following questionnaire:

1 Are you by law required to prepare annual financial statements for auditing? *YES / NO

1.1 If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.

.....

2 Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days? *YES / NO

2.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days.

2.2 If yes, provide particulars.

3 Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract? *YES / NO

3.1 If yes, furnish particulars

4. Will any portion of goods or services be sourced from outside the Republic, and, if so, what portion and whether any portion of payment from the municipality / municipal entity is expected to be transferred out of the Republic? ? *YES / NO

1.1 If yes, furnish particulars

CERTIFICATION

I, THE UNDERSIGNED (NAME)

.....
 CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS
 CORRECT.

I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION
 PROVE TO BE
 FALSE.

Signed Date

Name Position

Tenderer

MBD 8

FORM A20: Declaration of Bidder's Past Supply Chain Management Practices

- 1 This Municipal Bidding Document must form part of all bids invited.
- 2 It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.
- 3 The bid of any bidder may be rejected if that bidder, or any of its directors have:
 - a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;
 - b. been convicted for fraud or corruption during the past five years;
 - c. willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
 - d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).
- 4 **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**
- 5

Item	Question	Yes	No
4.1	Is the bidder or any of its directors listed on the National Treasury's database as a company or person 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 <i>audi alteram partem</i> rule was applied).	Yes ☐	No ☐
4.1.1	If so, furnish particulars:		
4.2	Is the 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 ☐
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	Yes ☐	No ☐
4.3.1	If so, furnish particulars:		
Item	Question	Yes	No

PART T2: RETURNABLE DOCUMENTS
BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes ☐	No ☐
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	Yes ☐	No ☐
4.7.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME)

**CERTIFY THAT THE INFORMATION FURNISHED ON THIS
DECLARATION FORM 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.**

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

MBD 9

FORM A21: Certificate of Independent Bid Determination

1. This Municipal Bidding Document (MBD) must form part of all bids¹ 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 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
 - a. take all reasonable steps to prevent such abuse;
 - b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
 - c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
- 4 This MBD 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 (MBD 9) 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 Municipality / Municipal Entity)

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 consortium³ will not be construed as collusive bidding.

PART T2: RETURNABLE DOCUMENTS
BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

MBD 9(Cont.)

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.
10. 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.

Signature

Date

Capacity under which Bid is Signed

Name of Bidder

FORM B1: Authority of Signatory

Details of person responsible for tender process:

Name

.....

Contact number

.....

Office address

.....

Signatories for close corporations and companies shall confirm their authority by attaching to this form a **duly signed and dated original or certified copy on the Company Letterhead** of the relevant resolution of their members or their board of directors, as the case may be.

PRO-FORMA FOR COMPANIES AND CLOSE CORPORATIONS:

"By resolution of the board of directors passed on *(date)*

Mr

has been duly authorized to sign all documents in connection with the Tender for Contract Number

.....and any Contract which may arise there from on

behalf of

(BLOCK CAPITALS)

SIGNED ON BEHALF OF THE COMPANY

IN HIS CAPACITY AS

DATE

FULL NAMES OF SIGNATORY

AS WITNESSES: 1.

2.

FORM B2: Execution Programme

The Tenderer shall attach a preliminary programme reflecting the proposed sequence and tempo of execution of the various activities comprising the work for this Contract. The programme shall be in accordance with the information supplied in the Contract, requirements of the Project Specifications and with all other aspects of the Tender.

Specific reference is made to the Clause 5.8.1 in the Contract Data for allowances of special non-working days. Allowance for inclement weather days shall base on the historical weather data supplied in PART C4: SITE INFORMATION contained in this document.

[Note: The programme must be based on the completion time as specified in the Contract Data. No other completion time that may be indicated on this programme will be regarded as an alternative offer.]

SIGNATURE:.....DATE:
(of person authorized to sign on behalf of the Tenderer)

FORM B3: Contractor's Health and Safety Declaration

In terms of Clause 4(4) of the OHS Act 1993 Construction Regulations 2014 (referred to as "the Regulations" hereafter), a Contractor may only be appointed to perform construction work if the Employer is satisfied that the Contractor has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act No 85 of 1993 and the OHS Act 1993 Construction Regulations 2014.

To that effect a person duly authorized by the tenderer must complete and sign the declaration hereafter in detail.

Declaration by Tenderer

1. I, the undersigned hereby declare and confirm that I am fully conversant with the Occupational Health and Safety Act No 85 of 1993 (as amended by the Occupational Health and Safety Amendment Act No 181 of 1993), and the OHS Act 1993 Construction Regulations 2014.
2. I hereby declare that my company has the competence and the necessary resources to safely carry out the construction work under this contract in compliance with the Construction Regulations and the Employer's Health and Safety Specifications.
3. I hereby confirm that adequate provision has been made in my tendered rates and prices in the Bill of Materials to cover the cost of all resources, actions, training and all health and safety measures envisaged in the OHS Act 1993 Construction Regulations 2014, including the cost of the specific items listed in the tables hereafter.

(Tables to be completed by Tenderer)

TABLE 1: COST OF SAFETY PERSONNEL

PERSONNEL	COSTS AS ALLOWED IN TENDER	NOMINATED PERSON/S
Construction Supervisor		
Construction Safety Officer		
Health and Safety Representatives		
Health and Safety Committee		

PART T2: RETURNABLE DOCUMENTS

BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

TABLE 2: COST OF SAFETY EQUIPMENT

EQUIPMENT	STATE YES or NO	COST ALLOWED FOR IN TENDER
Hard hats		
Safety boots		
Gloves		
Dust Masks		
Safety jackets		
Add items as per risk assessment:		

4. I hereby undertake, if my tender is accepted, to provide, before commencement of the works under the contract, a suitable and sufficiently documented Health and Safety Plan in accordance with Regulation 5(1) of the Construction Regulations, which plan shall be subject to approval by the Employer.
5. I confirm that copies of my company's approved Health and Safety Plan, the Employer's Safety Specifications as well as the OHSA 1993 Construction Regulations 2014 will be provided on site and will at all times be available for inspection by the Contractor's personnel, the Employer's personnel, the Engineer and his Agents, visitors, and officials and inspectors of the Department of Labour.
6. I hereby confirm that I will be liable for any penalties that may be applied by the Employer in terms of the said Regulations (Regulation 30) for failure on the Contractor's part to comply with the provisions of the Act and the Regulations.
7. I agree that my failure to complete and execute this declaration to the satisfaction of the Employer will mean that I am unable to comply with the requirements of the OHSA 1993 Construction Regulations 2014 and accept that my tender will be prejudiced and may be rejected at the discretion of the Employer.

SIGNATURE: DATE:
(of person authorized to sign on behalf of the Tenderer)

The Tenderer shall submit separately before commencement of the works his Health and Safety Plan as required in terms of Regulation 5 of the Occupational Health and Safety Act 1993 Construction Regulations 2014, and referred to in T2.1

**FORM B4: APPLICATION FOR A PERMIT TO DO CONSTRUCTION WORK,
Regulation 3(2) of Construction Regulations, 2014**

***[This form must be completed and forwarded, prior to commencement of work on site, by
all Contractors that qualify in terms of Regulation 3 of the Construction Regulations 2014,
to the office of the Provincial Director, Department of Labour]***

This application must be submitted with the following documents:

1. Health and Safety specifications
2. Health and Safety Plan
3. Baseline risk assessment

1. Name, postal address and telephone numbers of client:

Name.....

Postal address

.....

Telephone

2. Details of Agent

Title, Surname and Initials

ID/Passport No.....

Registration no. with SACPCMP

Office Tel/Mobile

Postal address

.....

3. Name, postal address and telephone numbers of the appointed principal contractor:

.....

.....

4. Name, postal address and telephone numbers of designer of project:

.....

.....

5. Name, postal address and telephone numbers of the following persons:

Construction Manager

Construction Health and Safety Manager

Construction Health and Safety Officer:

6. Exact physical address of construction and site office:

PART T2: RETURNABLE DOCUMENTS
BID No: ALMT14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER SUPPLY
SCHEME, PHASE 1 IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

.....
.....

7. Nature of construction work:

.....

8. Expected commencement date:

.....

9. Expected completion date:

.....

10. Estimated maximum number of people on the construction site:

.....

11. Planned number of constructors on site accountable to principal contractor:

.....

12. Name(s) of contractors appointed:

.....
.....
.....

13. Signature of Client/Client's Agent:

.....

14. Signature of Principal Contractor:

.....

MSCM Regulations: "in the service of the state" means to be –

- (a) a member of –
 - (i) any municipal council;
 - (ii) any provincial legislature; or
 - (iii) the national Assembly or the national Council of provinces;
- (b) a member of the board of directors of any municipal entity;
- (c) an official of any municipality or municipal entity;
- (d) an employee of 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);
- (e) a member of the accounting authority of any national or provincial public entity; or
- (f) an employee of Parliament or a provincial legislature.

FORM B5: PROJECT RISK MANAGEMENT AND METHOD STATEMENT

The Tenderer shall submit a detailed Method Statement describing the proposed approach for executing the Works in accordance with the project scope, specifications, and contractual requirements. The Method Statement must demonstrate a clear understanding of the project and provide a logical and practical sequence of activities for the successful implementation of the Works.

The Method Statement shall cover the full project lifecycle for the dam construction works, including but not limited to dam works, weir construction, access roads, associated structures, and pipelines as defined in the specifications.

The methodology for each project component shall address all technical, contractual, legal, and environmental requirements and shall include, as a minimum

- Project approach and construction methodology
- Site establishment (site offices, plant, labour, and equipment)
- Construction sequence and detailed work plan for each component (Dam, Weir, Roads, Structures, Pipeline)
- Contract administration and execution strategy
- Project programme (Bar Chart or CPM), including key milestones and critical path
- Resource planning (labour, plant, and materials)
- Contract Participation Goals (CPG) management, including the appointment, development, and monitoring of targeted enterprises
- Performance monitoring and reporting (Key Performance Indicators – KPIs)
- Quality management and assurance (QA/QC)
- Time and cost control measures
- Compliance with the Occupational Health and Safety Act and Construction Regulation
- Environmental management and compliance (Environmental Management Programme – EMP)
- Risk management and mitigation measures
- Materials sourcing and borrow pit management (if applicable)
- Testing, commissioning, and handover procedures
- Defects liability and maintenance requirements
- Project close-out and final documentation

The submission shall include a detailed Project Programme (construction schedule), clearly indicating activity sequencing, durations, critical path, milestones, and resource allocation.

The programme must include the following:

- Activity durations
- Logical links between activities (FS, SS, FF)
- Identification of the critical path
- Milestones for key deliverables
- Interfaces between civil, mechanical, and electrical works
- Allowance for prefabricated elements and procurement lead times

SIGNATURE: DATE:
(of person authorized to sign on behalf of the Tenderer)

PART C3:

SCOPE OF WORK

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

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THE CONTRACT

PART C3: SCOPE OF WORKS

C3.1 Description of Works

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

Part C3: Scope of Work

3.1 DESCRIPTION OF WORKS

C3.1.1 EMPLOYERS OBJECTIVES

This project forms part of the Chief Albert Luthuli Municipality's overall development of infrastructure within the municipality's boundaries.

C3.1.2 OVERVIEW OF THE WORKS

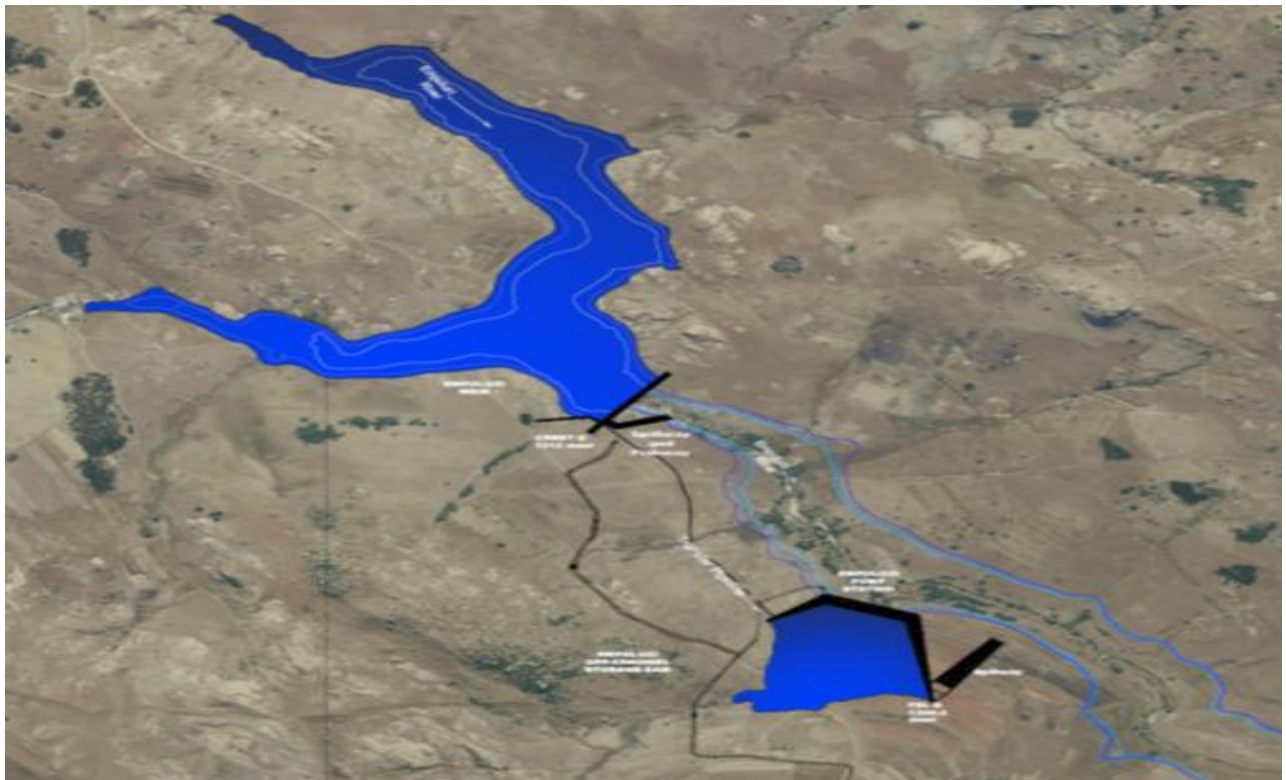
This project, The Construction of Empuluzi/Methula Bulk Water Supply Scheme in Chief Albert Luthuli Local Municipality, Phase 1, forms part of the Chief Albert Luthuli Municipality's overall infrastructure development programme. The programme involves the refurbishment and upgrading of various infrastructure components and has been implemented in a phased approach, namely Phases 2B, 3A, 3B, 4A, 4B, 5, 6, 7, and 8, to supply adequate bulk water to meet the demand of existing communities as well as future settlements. Phases 1 and 2A were incorporated into a single project to be implemented as Phase 1 to be implemented.

The abstraction weir is proposed to be constructed in eMpuluzi River to abstract raw water and transfer it to Empuluzi OCS Dam. Raw water will be pumped to existing WTWs at Methula and Mayflower.

The main objective of Phase 1 of the project is to increase and stabilize potable water supply to communities in the greater Mayflower/Empuluzi and Methula area in the dry season, when the abstractions at both Methula and Mayflower fail to yield the required treatment capacities

C3.1.2 OVERVIEW OF THE WORKS

The works consist of the following infrastructure, as shown in the map below, and with the described scope below:



The work to be executed under this contract includes the abstraction, storage, conveyance, pumping and release of raw water. The works include all civil, mechanical, electrical, instrumentation and control

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

infrastructure associated with establishing an off-channel storage dam on the eMpuluzi River and all associated temporary works and sourcing of construction materials.

The Scope of Works covers the following:

- a) Construction Work
- b) Quarrying and Processing Rockfill/Aggregate and Borrow Materials for Dam Works
- c) Temporary Access Roads and Roadworks Materials
- d) Maintenance of Facilities
- e) The works consist of Abstraction, pumping, conveyance system, storage system and release system.

The Contractors will be appointed with a minimum Construction Industry Development Board (CIDB) grading of 9CE.

C3.1.2.1 Extent of the Works

The work to be executed under this contract includes inter alia, for the supply of all prescribed materials, the plant and labour involved for the construction of the following, and not limited to the same for:

- 1) Site establishment, access, security, setting out, and compliance with the approved Health and Safety Plan and Environmental Management Programme (EMPr)
- 2) Provision of temporary access to site
- 3) Provision of temporary electrical, water and sewerage services relating to the Works.
- 4) Construction of a 22m high concrete eMpuluzi Weir with 600mm dia pipeline to fill OCS Dam
- 5) Construction of a Category II eMpuluzi Off-Channel Storage Dam (OCSD) with a gross storage capacity of approximately 1.01 million cubic metres at Full Supply Level (FSL) 1308.2 masl, including:
 - a) Rockfill embankment with clay core;
 - b) Crest length approximately 779 m;
 - c) Spillway structures;
 - d) Outlet works;
 - e) Scour system;
 - f) Seepage control measures;
 - g) Associated appurtenant work
- 6) Construction of a High Lift Pump Station, intake works and associated pipelines to the existing Methula and Mayflower Water Treatment Works, including all surge protection, valves, pipe supports, thrust blocks and associated civil, mechanical and electrical infrastructure
- 7) Construction of an Intake Tower within the OCSD including four outlet levels, access bridge/walkway and all associated mechanical and electrical equipment
- 8) Construction of bulk rising mains to Mayflower and Methula Water Treatment Works, comprising:
 - a) Approximately 8 km of 315 mm diameter oPVC Class 25 pipeline to Methula WTW; and
 - b) Approximately 12 km of 400 mm diameter oPVC Class 25 pipeline to Mayflower WTW, including valves, air valves, scour valves, chambers, thrust blocks, pipe supports, river/road crossings and associated appurtenant works
- 9) Foundation treatment and geotechnical remedial works for concrete structures and embankments where required, including excavation, cutoff trenches, grouting, seepage control and stabilisation measures.
- 10) Access Road to the new infrastructure – Construction of concrete paved access roads approximately 6 km long to service and provide access to the Abstraction Weir, Off-Channel Storage Dam (OCSD), High Lift Pump Station, Spillway and associated infrastructure.

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

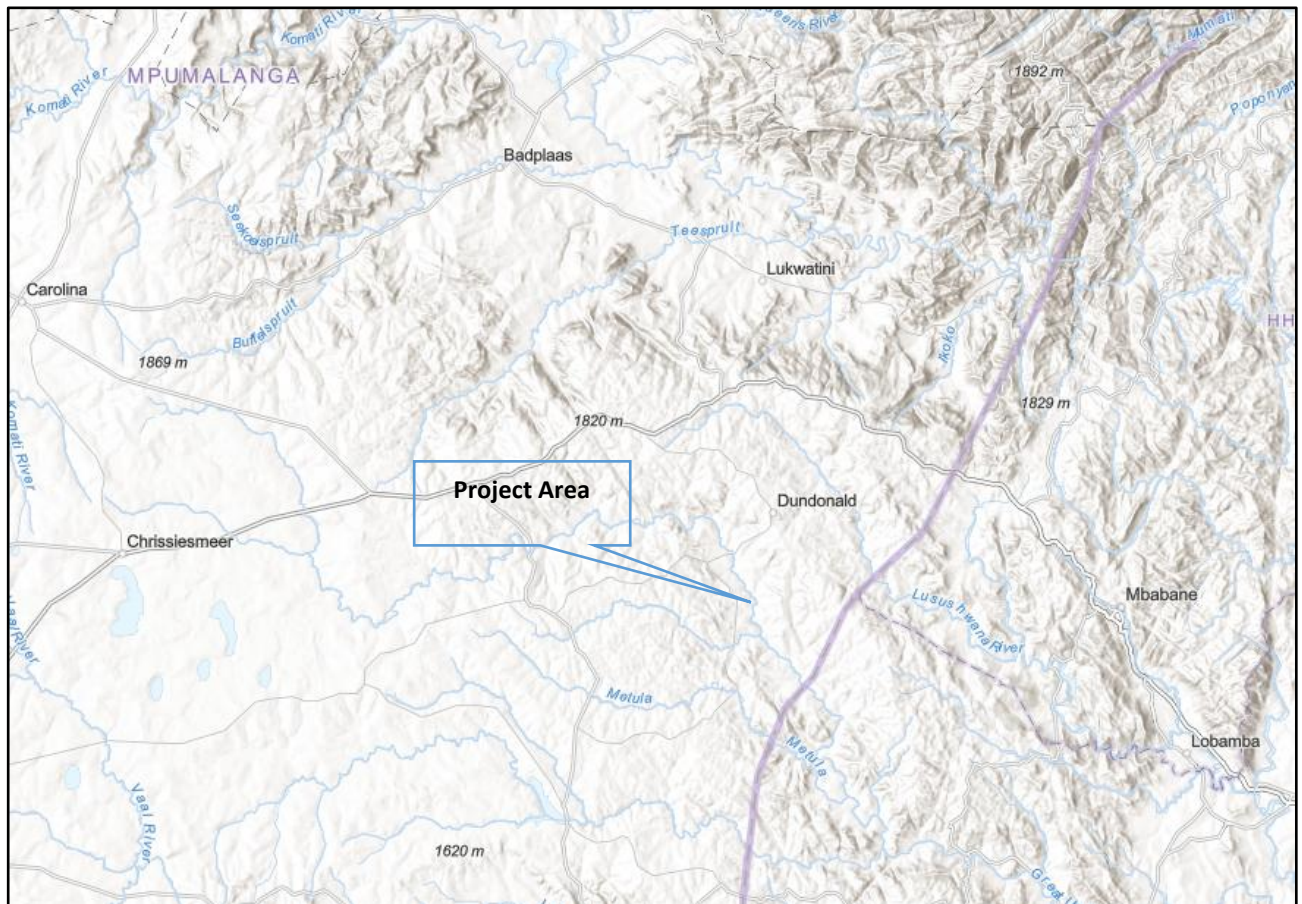
- 11) Design, detailing, fabrication, procurement, installation, testing and commissioning of:
 - a) Hydro-mechanical and mechanical equipment and plant;
 - b) All pipework and linings;
 - c) Electrical installations and reticulation;
 - d) Motor control centres (MCC);
 - e) Standby power supply system's where required;
 - f) Instrumentation and control systems;
 - g) Dam monitoring instrumentation;
 - h) Flow measuring instrumentation;
 - i) SCADA and telemetry systems;
 - j) Computerised operation, monitoring and data recording systems.
- 12) Provision of permanent electrical power supply, control systems, telemetry, communication and instrumentation services relating to the Works.
- 13) Protection of the environment including erosion protection, stormwater management, rehabilitation of disturbed areas, borrow pit rehabilitation, landscaping and alien vegetation control.
- 14) Testing and commissioning of the Works at various stages including pressure testing, functional testing, pump testing, electrical testing, instrumentation testing, reliability testing, operator training and provision of Operating and Maintenance Manuals.
- 15) Compliance with all Environmental, Occupational Health and Safety and Dam Safety requirements in accordance with the National Water Act, Dam Safety Regulations, approved EMPr and all applicable South African legislation.
- 16) Liaison and coordination of construction activities with the Advance Works Contractor and Abstraction Works Contractor, including programme coordination, interface management and access arrangements.
- 17) Sourcing, development and management of quarry, borrow pit and construction material sources required for the Works, including all statutory approvals and rehabilitation obligations.
- 18) Provision of temporary works including river diversion works, cofferdams, dewatering systems, temporary stormwater management and temporary construction facilities required for execution of the Works.
 - a) Preparation and submission of:
 - b) Construction drawings;
 - c) Shop drawings;
 - d) Method statements;
 - e) Quality control plans;
 - f) Survey records;
 - g) Geotechnical records;
 - h) As-built drawings;
 - i) Asset registers; and
 - j) Operation and Maintenance Manuals.
- 19) Remedying of defects in the Works during the 12-month Defects Liability Period.

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

C3.1.2.2 Location of the Works

The project falls within Chief Albert Local Municipality (CALLM), within the jurisdiction of Gert Sibande District Municipality. The project area is located in the southern/southeastern part of Mpumalanga. The coordinate

Access to the site is gained through R33. The project area is approximately 50km east of Ermelo. The co-ordinates of the project area, proposed weir site, are Latitude 26°21'9.94" South and Longitude 30°48'35.06" East.



Co-ordinates of Major structures at the

Infrastructure Description	Latitude	Longitude
Weir / Dam	26°21'9.94"S	30°48'35.55"E
Off-Channel Storage Dam	26°21'41.46"S	30°48'58.33"E
Pumpstation	26° 5'12.68"S	30° 7'17.55"E
Pipeline to Methula	26°22'34.59"S	30°48'36.90"E
Pipeline to Mayflower	26°19'8.92"S	30°47'29.12"E
Road Start	26°20'50.51"S	30°47'2.82"E
Road End	26°21'39.07"S	30°48'52.78"E

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
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C3.1.3 Labour Intensive Construction

Labour Intensive Construction shall mean the economically efficient employment of as great a portion of labour as is technically feasible to produce a standard of construction as demanded by the Specifications with completion by the Due Completion Date, thus the effective substitution of labour for equipment.

Appropriate portions of the Works included in the Contract shall be executed using Labour Intensive Construction methods.

Except where the use of plant is essential in order, in the opinion of the Engineer, to meet the specified requirements by the Due Completion Date, the Contractor shall use only hand tools and equipment in the construction of those portion(s) of the Works that are required in terms of these Project Specifications to be constructed using Labour Intensive Construction methods.

These portions of the Works shall be constructed utilising only locally employed labour and/or the labour of local sub-contractors, supplemented to the extent necessary and unavoidable by the Contractors key personnel as provided for in sub-clause C3.1.3 unless otherwise instructed by the Engineer and in accordance with the further provisions of the relevant sections of Part C3 of the Scope of Works.

The portions of the Works to be executed using Labour Intensive Construction methods are:

1. Site Establishment and General Works

- Site clearing and grubbing.
- Removal of vegetation.
- Fencing and barricading assistance.
- Traffic accommodation support.
- Site housekeeping and cleaning.
- Environmental monitoring assistants.

2. Access Roads (Highest LIC Potential)

- Clearing and grubbing.
- Topsoil stripping and stockpiling.
- Excavation of side drains.
- Construction of mitre drains.
- Construction of stormwater channels.
- Installation of road signs.
- Construction of gabions.
- Placement of erosion protection.
- Hand packing of stone pitching.
- Kerbing and edging.
- Landscaping and reinstatement.

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
DAM

3. Pipeline Construction

- Trench excavation in soft material.
- Bedding placement.
- Selected backfill placement.
- Compaction assistance.
- Valve chamber excavation.
- Concrete blinding works.
- Marker post installation.
- Pipeline route clearing.
- Erosion control measures.

4. Dam Construction

- Vegetation clearing.
- Topsoil stripping.
- Borrow pit rehabilitation.
- Hand trimming of slopes.
- Placement of riprap assistance.
- Filter material placement assistance.
- Drainage layer construction.
- Landscaping and rehabilitation.
- Access track construction.

5. Weir Construction

- Site clearing.
- Formwork cleaning.
- Concrete curing activities.
- Riverbank protection works.
- Stone pitching.
- Gabion construction.
- Erosion control measures.
- Landscaping and rehabilitation.

6. Buildings and Pump Station

- Minor excavation.
- Building surrounds.
- Walkways.

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- Paving.
- Landscaping.
- Stormwater channels.
- Fencing.

7. Environmental Management

- Alien vegetation removal.
- River rehabilitation.
- Wetland rehabilitation.
- Grassing and hydroseeding.
- Erosion protection.
- Topsoil spreading.
- Environmental monitoring assistants.

8. Testing and Commissioning Support

- Cleaning of reservoirs and structures.
- Assisting with flushing operations.
- Site reinstatement.

In respect of those portions of works which are not listed above, the construction methods adopted and plant utilised shall be at the discretion of the Contractor, provided always that the construction methods adopted and plant utilised by the Contractor are appropriate in respect of the nature of the Works to be executed and the standards to be achieved in terms of the Contract.

C3.1.4 Sub-Contracting

- C3.1.4.1** Contractor shall appoint such authorities and/or specialist subcontractors and suppliers as may be designated or nominated by the Employer or the Engineer.
- C3.1.4.2** The Contractor shall sub-let to local small sub-contractors appropriate portions of the works that are designated in Clause C3.1.3 as being reserved for labour intensive construction methods.
- C3.1.4.3** As required by Clause 4.4.5 of the Conditions of Contract, the Contractor shall be responsible for all work carried out by sub-contractors (whether nominated by the Employer or selected by the Contractor) on his behalf. The Engineer will not liaise directly with any such sub-contractor, nor will he become involved in any problems and/or disputes related to payments, programming, workmanship, etc. unless provided for in the Conditions of Contract. Such problems and/or disputes shall remain the sole concern of the Contractor and his sub-contractors.
- C3.1.4.4** The Engineer may at his discretion, upon receipt of a written and fully motivated application from the Contractor, and where he deems the circumstances so warrant, and provided always that the Contractor has complied fully and in all respects with the provisions of the Contract pertaining to subletting to local sub-contractors or has utilised his best endeavours to comply therewith, authorise in writing that the Contractor may employ local residents with the sole intent of executing on-the-job training of such local residents to suitable levels of skill that will enable the Contractor to sub-let appropriate portions of the Works to such local residents.

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Without limiting the generality of application of this sub-clause, circumstances, which may be considered by the Engineer to warrant such authorization, include:

- a) non-receipt of valid or acceptable tenders/quotations from local sub-contractors;
- b) serious default or failure of appointed local sub-contractors;

The Engineer shall not grant such authority in cases where it may reasonably be concluded on the available evidence that the invitation of further tenders/quotations in accordance with the terms of the Contract, is likely to result in the successful completion of the portions of the Works concerned by local sub-contractors.

Should the Contractor, after suitable due endeavour, be unable to identify local residents suitable for and desiring to train as sub-contractors for portions of the Works as specified in Clause 3.1.4.2, then the Contractor shall be permitted to undertake the Works in question with his own workforce as provided for in Clause 3.1.3 above.

The Engineer shall monitor progress achieved with subcontractor training, and successful completion of this training shall be subject to his approval or instruction. The Contractor shall tender rates for the training of sub-contractors and labour.

As specified in Clause C3.1.4, the Contractor shall approach the Labour Desk that is established for purposes of the Contract for assistance and advice regarding conditions of employment, minimum wages, disputes and disciplinary procedures in respect of local sub-contractors.

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C3.1.5 CONSTRUCTION AND MANAGEMENT REQUIREMENTS

C3.1.5.1 General

The Contractor is referred to SANS 1921: 2004 parts 1, 2, 3 and 5: Construction and Management Requirements for Works Contracts. These specifications shall be applicable to the contract under consideration and the Contractor shall comply with all requirements relevant to the project.

Certain aspects however require further attention as described hereafter.

The Contractor shall exercise due diligence and care in constructing the Works, in order to ensure that no damage is caused to public or private property or to the property of the Municipality and that danger to persons, fauna, flora and livestock are limited to the extent that is reasonably possible.

The Contractor shall indemnify the Municipality against any and all claims that may arise from his construction of the Works, as required by the Conditions of Contract. It is the responsibility of the tenderers to acquaint themselves of the geology and soil conditions of the site before submitting a tender.

C3.1.5.2 Quality Assurance (QA) *(Read with SANS 1921 – 1: 2004 clause 4.4)*

The Contractor shall be solely responsible for the production of work that complies in all respects with the Specifications, Drawings and approved construction tolerances to the satisfaction of the Engineer.

The Contractor shall establish, implement and maintain an approved Quality Assurance (QA) System for the duration of the Contract. The QA System shall be appropriate to the nature and complexity of the Works and shall include all earthworks, dam embankment construction, concrete works, pipelines, drainage works, blasting operations, material processing and ancillary infrastructure associated with the Contract.

The Contractor shall submit a detailed Quality Assurance Plan within 14 days of commencement of the Contract for approval by the Engineer. The QA Plan shall include, but not be limited to, the following:

- Organogram and responsibilities of quality personnel;
- Inspection and Test Plans (ITPs);
- Method statements for all critical construction activities;
- Material source approvals and traceability procedures;
- Survey and setting out control procedures;
- Testing frequencies in accordance with SANS, COTO and project specifications;
- Procedures for management of non-conforming work;
- Calibration records for all testing and surveying equipment;
- Laboratory accreditation details;
- Record keeping and reporting procedures;
- Hold points and witness points requiring Engineer approval.

The Contractor shall provide all supervisory staff, survey equipment, testing equipment, transport, labour, tools and other resources necessary to effectively implement the approved QA System.

All testing shall be undertaken by a SANAS-accredited laboratory approved by the Engineer. The Contractor shall allow for all costs associated with sampling, testing, re-testing, transport and quality control measures necessary to demonstrate compliance with the Specifications.

Particular attention shall be given to:

- Moisture and density control of dam embankment materials;
- Placement and compaction of filter and transition zones;
- Foundation preparation and treatment;

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- Control of seepage and drainage measures;
- Concrete quality control;
- Blasting and excavation control;
- Monitoring of groundwater and dewatering operations.

The Engineer shall audit the Contractor's QA System and associated records on a regular basis to verify compliance with the Contract requirements. Such audits shall not relieve the Contractor of any responsibility for quality control, workmanship, materials or compliance with the Contract.

The Contractor shall maintain complete quality records on site, including test results, source approvals, inspection records, compaction records, concrete cube results, survey data, blasting records and as-built information. Copies of all records shall be submitted to the Engineer as part of the permanent project records.

The Contractor shall note that it is not the duty of the Engineer or the Engineer's Representative to act as foreman, site agent, quality controller or surveyor for the Works.

C3.1.5.3 Management and disposal of water *(Read with SANS 1921 - 1: 2004 clause 4.6)*

The Contractor shall be responsible for the management, control, diversion, pumping, treatment where necessary, and disposal of all water encountered during the execution of the Works, including river water, groundwater, seepage, stormwater, construction water, and water arising from dewatering operations.

The Contractor shall make adequate provision for the protection of excavations, foundations, embankments, concrete works, pipelines, roads, and all other permanent Works against flooding, erosion, scour, saturation, and other damage caused by water.

The Contractor shall design, construct, operate, maintain and remove all temporary works required for water management, including but not limited to:

- a) Temporary diversion channels;
- b) Cofferdams and berms;
- c) Cut-off drains and interceptor drains;
- d) Stormwater channels;
- e) Sumps and pumping systems;
- f) Dewatering systems;
- g) Sedimentation ponds and silt traps; and
- h) Temporary discharge pipelines.

Water discharged from the Works shall not cause erosion, flooding, sedimentation, pollution, nuisance, or damage to downstream properties, watercourses, roads, existing infrastructure, or the environment.

The Contractor shall comply with all requirements of the approved Environmental Management Programme (EMPr), Environmental Authorisation, Water Use Licence conditions, and all applicable legislation governing the protection of water resources.

Particular attention shall be given to preventing the discharge of silt-laden water, cement-contaminated water, hydrocarbon-contaminated water, or any other polluted water into natural watercourses.

The Contractor shall maintain all completed and partially completed Works in a dry and stable condition until Taking-Over. Any damage resulting from inadequate dewatering, drainage, diversion, or stormwater management shall be repaired by the Contractor at his own cost.

No separate payment shall be made for the management and disposal of water, dewatering operations, temporary diversions, pumping, stormwater control, or protection of the Works against water. The costs thereof shall be deemed to be included in the rates and prices tendered for the various items of the Works.

Claims for delays, additional costs, loss of productivity, repair of damaged Works, or extension of time arising from the Contractor's failure to adequately manage water and stormwater shall not be considered.

C3.1.5.4 Disposal of spoil or surplus material *(Read with SANS 1921 - 1: 2004 clause 4.10)*

The Contractor shall be responsible for the handling, transportation, stockpiling, reuse, and disposal of all surplus, unsuitable, excavated, and waste materials arising from the Works. Suitable excavated material shall, where approved by the Engineer, be reused in the Works for embankment construction, backfilling, landscaping, rehabilitation, or other approved purposes.

Surplus or unsuitable material not required for the Works shall be disposed of at approved disposal sites. Disposal sites shall comply with the requirements of the Environmental Authorisation, Environmental Management Programme (EMPr), municipal by-laws, and all applicable legislation.

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Where disposal at a licensed landfill facility is required, the Contractor shall make all necessary arrangements with the relevant authorities and shall be responsible for all permits, approvals, haulage, handling, tipping fees, and associated costs.

No material shall be dumped within watercourses, drainage lines, wetlands, servitudes, road reserves, environmentally sensitive areas, or on private property without the prior written approval of the Engineer and the relevant authority.

The Contractor shall ensure that all spoil disposal areas are properly shaped, drained, stabilised, and rehabilitated upon completion of the Works to the satisfaction of the Engineer and Environmental Control Officer.

The Contractor shall maintain records of all spoil disposal activities and shall provide proof of disposal at approved facilities upon request by the Engineer.

No separate payment shall be made for the handling, stockpiling, transportation, disposal, or rehabilitation associated with spoil and surplus material unless otherwise provided for in the Bill of Quantities. The costs thereof shall be deemed to be included in the tendered rates and prices

C3.1.5.6 Testing *(Read with SANS 1921 – 1: 2004 clause 4.11)*

- **Process Control**

The Contractor shall be responsible for carrying out all testing required for process control and quality assurance to demonstrate compliance with the Specifications, Drawings, applicable standards, and the approved Quality Management Plan.

All testing shall be undertaken by a laboratory acceptable to and approved by the Engineer. The laboratory shall be accredited by the South African National Accreditation System (SANAS) for the applicable test methods, where such accreditation is available.

The Contractor may establish a site laboratory or engage the services of an independent commercial laboratory, subject to the approval of the Engineer.

The Contractor shall submit all test results, inspection records, calibration certificates, quality records, and compliance certificates to the Engineer prior to requesting inspection, approval, or acceptance of the Works.

Testing shall include, but not be limited to:

- a) Earthworks and embankment compaction testing;
- b) Foundation investigations and foundation treatment verification;
- c) Concrete materials testing, batching control, slump testing, compressive strength testing, and durability testing;
- d) Aggregate, filter, drainage, and riprap material testing;
- e) Pipeline bedding, backfill, and compaction testing;
- f) Hydrostatic pressure testing and leakage testing of pipelines;
- g) Weld testing and non-destructive testing where applicable;
- h) Mechanical equipment inspections and testing;
- i) Electrical installation testing, protection testing, and commissioning;
- j) Instrumentation calibration and functional testing; and
- k) Any other testing required by the Specifications, applicable standards, or instructed by the Engineer.

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The costs associated with process control testing, quality assurance, supervision, inspections, quality records, and compliance documentation shall be deemed to be included in the tendered rates and prices, and no separate payment shall be made therefor.

- **Acceptance Control**

The Engineer may use the Contractor's process control test results for acceptance purposes. However, the Engineer reserves the right to carry out independent acceptance testing, audits, inspections, and verification testing through a laboratory or specialist service provider of his choice.

The cost of such acceptance testing shall be paid from the relevant provisional sum included in the Bill of Quantities.

Where any acceptance test indicates non-compliance with the Specifications, the Contractor shall bear the full cost of all repeat testing, investigations, corrective works, specialist assessments, and associated delays arising therefrom.

No portion of the Works shall be deemed accepted until all specified testing has been completed and the Engineer has issued written acceptance.

- **Commissioning and Performance Testing**

The Contractor shall perform all pre-commissioning, commissioning, performance, reliability, and Tests on Completion required for the civil, mechanical, electrical, control, instrumentation, and dam monitoring systems.

All testing procedures, test records, and commissioning reports shall be submitted to the Engineer for approval.

The Contractor shall provide all labour, plant, equipment, instruments, consumables, temporary services, and specialist personnel necessary to execute the testing and commissioning of the Works.

C3.1.5.7 Survey beacons (*Read with SANS 1921 - 1 : 2004 clause 4.15*)

The Contractor shall take all necessary precautions to protect and preserve all survey beacons, benchmarks, reference marks, property boundary pegs, trigonometrical beacons, control points, and other survey markers, whether established before or during the execution of the Contract.

Prior to commencing any construction activities, the Contractor shall satisfy himself as to the position and condition of all survey markers that may be affected by the Works and shall immediately notify the Employer's Agent of any discrepancies or damage observed.

The Contractor shall ensure that no survey marker is disturbed, damaged, removed, obscured, or relocated without the prior written approval of the Employer's Agent and, where applicable, the relevant authority. Where survey markers are likely to be affected by the Works, the Contractor shall establish and maintain suitable offset reference points and records, subject to the approval of the Employer's Agent.

Should any survey beacon, benchmark, peg, control point, or other survey marker be disturbed, damaged, destroyed, or removed as a result of the Contractor's operations or those of his employees, subcontractors, suppliers, or plant, the Contractor shall, at his own cost, arrange for its replacement or reinstatement by a registered Professional Land Surveyor.

The replacement or reinstatement shall be carried out to the satisfaction of the Employer's Agent and the relevant authority having jurisdiction. The Contractor shall provide the Employer's Agent with all survey records, coordinates, level data, and certificates relating to the reinstatement.

The Contractor shall be liable for all costs, delays, claims, and consequences arising from the disturbance, damage, destruction, or loss of survey control points resulting from his activities.

No separate payment shall be made for the protection, maintenance, referencing, replacement, or reinstatement of survey markers, and the costs thereof shall be deemed to be included in the tendered rates and prices..

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C3.1.5.8 Existing Services *(Read with SANS 1921 - 1 : 2004 clause 4.17)*

The Contractor shall, before commencing any excavation, drilling, blasting, piling, trenching, or other construction activity that may affect existing services, satisfy himself as to the position, depth, nature, and extent of all existing above ground and underground services within or adjacent to the Site.

The Contractor shall obtain all available information regarding existing services from the Employer, relevant authorities, utility owners, and service providers. The provision of drawings or information by the Employer shall not relieve the Contractor of his responsibility to verify the position and condition of existing services.

The Contractor shall locate and verify all existing services by means of appropriate detection methods, trial pits, hand excavation, or other approved methods prior to commencing construction activities in the vicinity of such services.

The Contractor shall exercise all necessary precautions to protect existing services from damage, interruption, contamination, settlement, vibration, or any other adverse effects resulting from his operations.

The Contractor shall be fully responsible for any damage caused to known existing services by his employees, subcontractors, suppliers, plant, or operations. Any such damage shall be immediately reported to the Employer's Agent and the relevant service owner and shall be repaired or reinstated by the Contractor at his own cost and to the satisfaction of the service owner and Employer's Agent.

Should previously unidentified or unknown services be encountered during the execution of the Works, the Contractor shall immediately cease operations in the affected area, protect the service from damage, notify the Employer's Agent, and await further instruction before proceeding.

Any damage to unidentified or unknown services shall be repaired as soon as reasonably practicable to minimise disruption and risk. Responsibility for the associated costs shall be determined in accordance with the Conditions of Contract and the circumstances surrounding the occurrence.

Where temporary support, relocation, diversion, protection, or reinstatement of existing services is required, the Contractor shall submit detailed proposals to the Employer's Agent for approval prior to undertaking such work.

No separate payment shall be made for locating, verifying, protecting, supporting, or working around existing services, and the costs thereof shall be deemed to be included in the tendered rates and prices, unless specifically provided for elsewhere in the Contract.

C3.1.6 Programme to be supplied by the Contractor

The Contractor shall prepare and submit a detailed Contract Programme in accordance with the requirements of the Conditions of Contract and the Scope of Works.

The Programme shall demonstrate the Contractor's proposed method of executing and completing the Works within the Time for Completion and shall be consistent with the Contractor's planned resources, construction methodology, procurement strategy, commissioning requirements, and all contractual milestones.

The Programme shall not consist solely of a bar chart. It shall include, as a minimum:

- a) A Critical Path Method (CPM) network programme based on the precedence method;
- b) Detailed construction activities and logical relationships between activities;
- c) Procurement activities for long-lead materials, equipment, and specialist subcontractors;
- d) Design, shop drawing, fabrication, delivery, installation, testing, commissioning, and handover activities where applicable;

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- e) Resource loading showing labour, plant, equipment, and key personnel requirements;
- f) Monthly cashflow projections and anticipated earnings;
- g) Key milestones, sectional completion dates, Tests on Completion, commissioning activities, and Taking-Over requirements;
- h) Float and critical path identification; and
- i) Interfaces and coordination requirements with other contractors, utility providers, authorities, and stakeholders.

The Programme shall be prepared using Microsoft Project, or other scheduling software approved by the Employer's Agent.

The Contractor shall submit the initial Programme within fourteen (14) days of the Commencement Date, or such other period as stated in the Contract Data.

The Programme shall be updated monthly to reflect actual progress achieved, revised forecasts, approved variations, extension of time claims, changes in sequencing, and other relevant events affecting the progress of the Works.

Updated Programmes shall be submitted to the Employer's Agent not less than five (5) working days prior to each monthly progress meeting.

Failure to submit an acceptable Programme or updated Programme shall entitle the Employer's Agent to withhold approval of payment certificates to the extent permitted by the Conditions of Contract and to assess claims for extension of time or additional payment using such information as may be available.

Should actual progress fall behind the approved Programme, or should the Contractor materially deviate from the planned sequence of operations, the Contractor shall, submit a revised recovery programme indicating the measures proposed to regain lost time and achieve completion within the Time for Completion or any approved extension thereof as defined in Clause 5.7.3

Any proposal to recover lost time shall clearly demonstrate the additional resources, plant, working hours, shifts, construction methods, or other measures that will be implemented to achieve the required progress.

Approval of the Programme by the Employer's Agent shall not relieve the Contractor of any obligations under the Contract, nor shall it constitute acceptance of the adequacy of the Programme or the Contractor's methods and resources. The Contractor is also referred to Clause 5.6 of the General Conditions of Contract when drawing up his programme

Failure by the Contractor to submit, update, or work in accordance with the approved Programme may constitute grounds for action in terms of the relevant provisions of the Conditions of Contract, Clause 9.2.

C3.1.7 Overhaul

Provision for overhaul has been made in the Contract as a Provisional Quantity.

For the purposes of this Contract, overhaul shall mean the transportation of suitable excavated material beyond the free-haul distance specified elsewhere in the Contract Documents and authorised by the Employer's Agent. No overhaul shall be undertaken without the prior written instruction or approval of the Employer's Agent.

Payment for overhaul shall only be made where:

- a) The material has been excavated from an approved source;
- b) The haul distance has been measured and agreed with the Employer's Agent;
- c) The movement of material is necessary for the execution of the Works;
- d) The haul exceeds the specified free-haul distance; and
- e) The Contractor has maintained adequate records of the quantities and haul distances involved.

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The Contractor shall submit supporting survey records, haul route information, quantity calculations, and any other information reasonably required by the Employer's Agent to substantiate claims for overhaul.

No payment shall be made for overhaul resulting from the Contractor's inefficient operations, rehandling of materials, poor planning, temporary stockpiling for the Contractor's convenience, or any movement of material not authorised by the Employer's Agent.

Payment for approved overhaul shall be made at the applicable rate provided in the Bill of Quantities.

C3.1.8 Site Facilities Available

C3.1.8.1 Location of Site and Depot

The Contractor shall be responsible for selecting, establishing, operating, maintaining and removing his site camp, offices, workshops, stores, laydown areas, batching facilities and accommodation required for the execution of the Works.

Should the Employer identify any area that may be suitable for use by the Contractor, such area will be pointed out during the Site Inspection. The Contractor shall obtain the written consent of the landowner and the approval of the Employer's Agent prior to establishing any camp or depot.

(a) Contractor's Camp Site/Store Yard

Any Any clearing, grubbing, fencing, preparation, maintenance, rehabilitation and reinstatement of the camp site shall be the responsibility of the Contractor.

In addition to the requirements of SANS 1200 A Clause 8.3.2.2, the following shall apply:

- i. Access to the Site will be via temporary and permanent access roads to be constructed under this Contract. The Contractor shall maintain all access routes used by him in a safe and serviceable condition throughout the Contract period.
- ii. The Contractor shall take all reasonable measures to prevent damage to existing public roads, farm roads, access tracks, services, fences, gates and other infrastructure used during the execution of the Works. Any damage arising from the Contractor's operations shall be repaired at his own cost to the satisfaction of the Employer's Agent and the affected owner or authority.
- iii. No potable water supply, waterborne sewerage system, electrical supply, telecommunications service or other utility service is available at the Site unless otherwise indicated in the Contract Documents. The Contractor shall make his own arrangements for all temporary services required for the execution of the Works.
- iv. The Contractor shall provide all temporary sanitation facilities, water supply systems, power supply systems, waste management facilities and environmental protection measures necessary for the operation of the site establishment.
- v. Upon completion of the Works, the Contractor shall remove all temporary facilities and reinstate the camp site and all affected areas to a condition at least equal to that existing prior to occupation, to the satisfaction of the Employer's Agent, Environmental Control Officer and landowner.
- vi. Written clearance confirming satisfactory reinstatement shall be obtained from the landowner and submitted to the Employer's Agent prior to the issue of the Certificate of Completion.

The Contractor shall not establish camps, workshops, fuel storage areas, batching plants, spoil areas or stockpile areas within any watercourse, wetland, flood line, environmentally sensitive area or area identified as a no-go area in the Environmental Authorisation or EMPr.

C3.1.8.2 Source of Water Supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all water that he may require for purposes of constructing the Works. Accordingly, the Contractor shall pay all connection fees and consumption charges, and at his cost provide all connections, consumption meters, pipe work, storage tanks, transport and other items associated with the supply of water for the Works.

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The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making water available for purposes of constructing the Works.

C3.1.8.3 Source of Power Supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all electricity that he may require for purposes of constructing the Works. Accordingly, the Contractor shall pay all connection and consumption charges, and at his cost provide all connections, transformers, consumption meters, cables, distribution boards and other items that are associated with the supply of electricity for construction of the Works.

The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making electricity available for purposes of constructing the Works. The distribution of electricity shall be in accordance with the applicable bylaws and regulations of the supply authority.

C3.1.8.4 Accommodation of Employees

No employees except for security guards will be allowed to sleep or be accommodated on the site.

No housing is available for the Contractor's employees and the Contractor shall make his own arrangements to house his employees and to transport them to site.

No informal housing or squatting will be allowed.

The Contractor shall provide the necessary ablution facilities at his campsite and the site of the works for the use of his employees. Chemical toilets only will be allowed where temporary facilities have to be provided.

C3.1.9 Features Requiring Special Attention

C3.1.9.1 Built-up Areas

The Contractor's attention is drawn to the fact that portions of the pipeline works will be constructed within or adjacent to built-up and residential areas. The Contractor shall at all times exercise due care and take all necessary precautions to ensure the safety, convenience and minimum disruption to residents, businesses, pedestrians and the general public.

The Contractor shall plan and execute the Works in such a manner as to minimise inconvenience to affected properties and road users.

Where applicable, the Contractor shall:

- Maintain safe pedestrian and vehicular access to properties;
- Provide temporary crossings, steel plates, bridges or access ramps where required;
- Maintain access for emergency vehicles at all times;
- Provide and maintain adequate barricading, signage, lighting and warning devices;
- Ensure safe accommodation of traffic in accordance with the Specifications and approved traffic accommodation plans;
- Prevent unnecessary obstruction of roads, driveways and footpaths.

The Contractor shall make allowance in his programme for delays and restricted working conditions associated with construction in built-up areas.

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Residents and affected property owners shall be given a minimum of 48 hours written notice prior to any planned closure or restriction of access to residential properties or businesses. No access to any residential property or business shall be restricted for a continuous period exceeding 48 hours without the prior approval of the Engineer.

At the end of each working day, the Contractor shall ensure that all excavations, trenches, crossings and access points are left in a safe condition and that reasonable access is maintained wherever practicable.

Contractor's attention is drawn to the fact that the portions of the works may be constructed close to built-up areas. The Contractor shall exercise all necessary precautions and take all necessary steps to ensure the safety and convenience of the public. Where applicable, the Contractor shall provide access for traffic over and through the works and for residents to their places of abode, all as described in the Specifications. The Contractor in his programming must make allowance for delays resulting from the aforesaid.

The Contractor shall give residents a minimum of 48 hours written notice of his intent to close access to residential stands. No access to a residential stand shall be closed for a period longer than 48 hours

C3.1.9.3 Protection of Buildings and Structures

The Contractor shall give all residents or other parties owning a building or structure within an appropriate radius (not less than 100m) from any point of blasting, a minimum of 48 hours notice of his intent to execute any blasting work.

The Contractor shall note all aspects relevant to the condition of the affected buildings and/or structures prior to blasting, and shall acquire the signature of the owners/occupants agreeing to such conditions.

Subsequent to blasting, both the Contractor and the owners/occupants shall sign the form confirming the condition of the buildings and/or structures. In the event of damage to existing buildings and/or structures as a result of blasting, remedial work shall be done to the satisfaction of the owners/occupants at the Contractor's expense.

Compliance with this clause will not relieve the Contractor of any of his responsibilities in terms of the Contract.

C3.1.9.4 Care of the Site

At all times during the execution of the Works and upon completion thereof, the Contractor shall keep the Site and surrounding areas in a clean, safe and orderly condition. The Contractor shall store all materials, equipment, plant and tools in an orderly manner and shall keep the Site free from litter, debris, surplus material and unnecessary obstructions.

Clearing, grubbing, excavation, stockpiling and disposal of excess or waste material shall only take place within approved working areas indicated on the drawings or as authorised in writing by the Engineer.

The Contractor shall take all reasonable precautions to protect the environment, including surrounding vegetation, watercourses, fauna, flora and adjacent properties from damage arising from construction activities.

The Contractor shall further ensure that:

- Disturbance outside the approved construction footprint is minimised;
- Erosion and sedimentation are controlled;
- Dust, noise and pollution are adequately controlled;
- Waste materials are regularly removed from the Site and disposed of at approved disposal facilities;

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- No material is stockpiled within drainage lines, wetlands or environmentally sensitive areas unless approved by the Engineer.

In addition to the above, the following environmental mitigation measures shall apply during construction:

- a) The Contractor's plant maintenance and refueling areas shall be provided with suitable spill containment and oil disposal facilities. Any oil, fuel, diesel, hydraulic fluid or chemical spillages shall immediately be contained, cleaned up and contaminated material removed to an approved disposal facility at the Contractor's cost.
- b) No solvents, chemicals, cement slurry or hazardous substances shall be discharged onto the ground, into stormwater systems or into watercourses. Cleaning of containers or equipment using organic solvents shall only be undertaken in approved areas with suitable waste collection and disposal measures.
- c) Appropriate dust suppression measures shall be implemented throughout the Contract period. The Contractor shall dampen haul roads, access roads, trenching areas and other exposed surfaces at suitable intervals as directed by the Engineer to minimize dust nuisance.
- d) Upon completion of the Works, all disturbed areas not forming part of the permanent works shall be cleaned, shaped and rehabilitated to the satisfaction of the Engineer.

Failure by the Contractor, his employees or subcontractors to comply with the environmental protection requirements of the Contract shall constitute sufficient grounds for the Engineer to instruct the removal and replacement of the offending personnel or subcontractors from the Site.

C3.1.9.5 Control of Water

Contractor shall at all times be responsible for the control, management and disposal of all water associated with the Works, including stormwater, groundwater, seepage water, wastewater, pipeline discharge water and water arising from construction activities.

The Contractor shall take all necessary precautions to protect the Works, adjacent properties, roads, services and the environment from flooding, erosion, ponding, contamination and damage caused by water.

The Contractor shall be responsible for:

- Diverting and controlling stormwater runs off from higher-lying areas;
- Dewatering of trenches, excavations and working areas;
- Preventing ingress of water into excavations;
- Maintaining excavations in a safe and workable condition;
- Handling water discharged during pipe connections, pressure testing, valve operations and commissioning activities;
- Preventing erosion and sedimentation caused by construction activities.

Water pumped or discharged from excavations shall be disposed of in a controlled manner and shall not be allowed to cause flooding, erosion, nuisance or environmental damage.

No polluted water, contaminated water, wastewater, cement slurry, fuels, chemicals or other harmful substances shall be discharged into any stormwater system, watercourse, wetland, drainage line or surrounding property.

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Where disposal at an approved facility is required by the Specifications or environmental requirements, the Contractor shall make all necessary arrangements and bear all associated costs.

The Contractor shall comply with all requirements of the Environmental Management Programme (EMPr), environmental legislation and instructions issued by the Engineer and Environmental Control Officer.

All costs associated with the control, pumping, diversion, treatment, handling and lawful disposal of water shall be deemed to be included in the rates and prices tendered for the relevant items in the Bill of Quantities, and no separate payment shall be made

C3.1.10 Management of the Environment *(Read with SANS 1921 - 1: 2004 Clause 4.19)*

The Protection of the environment is of fundamental importance for this Contract, and the Contractor shall conduct all activities in a manner that minimises environmental disturbance, pollution and damage to surrounding communities, watercourses, vegetation and natural resources.

The Contractor shall comply in all respects with:

- The Environmental Authorization conditions;
- The approved Environmental Management Programme (EMPr);
- Applicable environmental legislation;
- Instructions issued by the Engineer and Environmental Control Officer (ECO).

The Contractor shall make adequate allowance in his rates and prices for all environmental protection, monitoring, rehabilitation and compliance obligations associated with the Works.

a) Natural Vegetation and Sensitive Areas

Only vegetation strictly necessary for the execution of the Works shall be cleared. No trees, shrubs or vegetation shall be removed unless approved by the Engineer and/or ECO.

The Contractor shall:

- Restrict all activities to approved working areas;
- Prevent unnecessary disturbance to natural vegetation;
- Protect wetlands, streams, drainage lines and environmentally sensitive areas;
- Prevent damage outside the approved construction footprint;
- Control the spread of alien invasive vegetation.

Topsoil removed during clearing operations shall be stockpiled separately and protected for later rehabilitation purposes.

b) Erosion and Stormwater Control

The Contractor shall implement effective erosion protection and stormwater control measures throughout the duration of the Works.

Particular attention shall be given to:

- Protection of exposed slopes and embankments;

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- Prevention of sediment entering watercourses;
- Stabilisation of spoil areas and stockpiles;
- Control of runoff from disturbed surfaces;
- Temporary drainage and diversion measures;
- Rehabilitation of completed areas.

The Contractor shall immediately repair any erosion damage caused by construction activities at his own cost.

c) Water Pollution Prevention

No contaminated water, cement slurry, fuels, oils, chemicals, sewage or other pollutants shall be allowed to enter any river, stream, wetland, drainage channel or groundwater system.

The Contractor shall provide:

- Adequate sanitation facilities;
- Bunded fuel and chemical storage areas;
- Spill containment equipment;
- Waste collection and disposal systems.

Refuelling and servicing of plant shall only take place in approved designated areas.

d) Fires

The Contractor shall comply with all statutory and local fire regulations and shall take all necessary precautions to prevent veld and bush fires.

No open fires shall be permitted on site except in approved designated areas.

In the event of fire, the Contractor shall immediately take all necessary steps to contain and extinguish the fire and shall be fully responsible for all damages, losses, claims and rehabilitation costs arising from fires caused by the Contractor, his employees or subcontractors.

e) Dust, Noise and Blasting Control

The Contractor shall control dust, noise and vibration arising from the Works to acceptable levels.

Dust suppression measures shall be implemented on haul roads, access roads, stockpile areas and exposed surfaces.

Blasting activities, where applicable, shall comply with all legal requirements and shall be carefully controlled to minimise nuisance, damage and safety risks to surrounding communities, structures and infrastructure.

f) Waste Management

The Contractor shall maintain the Site in a neat and orderly condition at all times.

All waste materials shall be collected, stored and disposed of at approved disposal facilities. No waste shall be buried or burned on site unless specifically approved.

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g) Environmental Monitoring and Compliance

The Contractor shall cooperate fully with the Engineer and ECO in all environmental inspections, audits and monitoring activities.

Any environmental incidents, spillages, pollution events, complaints or non-compliances shall immediately be reported to the Engineer and ECO together with proposed corrective measures.

Failure to comply with environmental requirements may result in work stoppages or penalties without relieving the Contractor of his contractual obligations.

h) Rehabilitation

Upon completion of the Works, all disturbed areas not forming part of the permanent works shall be rehabilitated to the satisfaction of the Engineer and ECO.

Rehabilitation shall include, where applicable:

- Removal of temporary work and waste;
- Regrading and shaping;
- Replacement of topsoil;
- Re-vegetation;
- Stabilisation of disturbed surfaces;
- Removal of alien vegetation

C3.1.11 Community Liaison and Community Relations

In all dealings with nearby communities and beneficiaries of the project, and in all dealings with workers employed from within such communities, the Contractor shall take due cognisance of the character, culture and circumstances of the specific community and/or any group of beneficiaries, and shall at all times use his best endeavours to avoid the development of disputes and rather to foster a spirit of co-operation and harmony towards the project.

The Contractor shall at all times, keep the Engineer fully informed regarding all matters affecting or negotiated between the Contractor and the community and/or beneficiaries, and he shall attend all liaison meetings as may be arranged by the Engineer and/or the Employer. All matters concerning the community and/or beneficiaries shall be discussed and where possible, resolved at such meetings.

Where any resolution during such negotiations or at such meetings shall be contrary to the terms and provisions of the Contract, the Contractor shall not give effect thereto without a prior written instruction from the Engineer. Where the Contractor is of the opinion that any instruction of the Engineer issued in terms of this clause will result in the incurring of additional costs which were not provided for in his tendered rates and prices and/or that a delay in the progress of the Works will result, he shall be entitled to submit a claim in terms of Clause 10 of the Conditions of Contract, provided always that the period of twenty-eight (28) days referred to in Clause 10 shall be reduced to three (3) normal working days in respect of all claims submitted in terms of this clause.

C3.1.12 Workmanship and Quality Control

The Contractor shall be solely responsible for producing work that conforms in all respects to the requirements of the Contract, including the Specifications, Drawings, approved designs, applicable standards, and the requirements of the Employer's Agent.

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The Contractor shall establish, implement, maintain and operate an effective Quality Management System (QMS) for the duration of the Contract. The QMS shall be submitted to the Employer's Agent for review prior to commencement of the Works and shall include, as a minimum:

- (a) Quality objectives and procedures;
- (b) Inspection and Test Plans (ITPs);
- (c) Method statements;
- (d) Material approval procedures;
- (e) Calibration procedures for testing and survey equipment;
- (f) Non-conformance reporting and corrective action procedures;
- (g) Quality records and document control procedures; and
- (h) Procedures for testing, commissioning and handover.

The Contractor shall provide suitably qualified and experienced engineers, construction managers, foremen, surveyors, materials technicians, quality control personnel, and other technical staff necessary to ensure adequate supervision and control of the Works.

The Contractor shall provide all labour, transport, survey equipment, testing equipment, instruments, laboratories, software, and other resources required for the proper execution and quality control of the Works.

The Contractor shall ensure that all materials incorporated into the Works comply with the relevant specifications and standards and shall maintain records demonstrating traceability, compliance certification, testing, inspection, and approval of such materials.

The cost of supervision, quality management, inspections, process control, testing, surveys, documentation, and all quality assurance activities undertaken by the Contractor shall be deemed to be included in the tendered rates and prices for the various items of work.

The Contractor shall comply with the minimum frequencies of process control testing specified in the applicable standards and specifications and shall increase such frequencies where necessary to ensure adequate control of workmanship and material quality.

Upon completion of any portion of the Works and prior to requesting inspection or acceptance by the Employer's Agent, the Contractor shall submit all relevant test results, inspection records, survey records, levels, certificates of compliance, calibration records, commissioning records where applicable, and any other documentation required to demonstrate compliance with the Contract.

The Employer's Agent may designate Hold Points and Witness Points for critical construction activities. No work shall proceed beyond a Hold Point without the written approval of the Employer's Agent.

The Employer's Agent shall not be obliged to inspect, examine, test, or accept any portion of the Works where the required quality records, test results, measurements, levels, certificates, or supporting documentation have not been submitted.

Approval, inspection, testing, or acceptance by the Employer's Agent shall not relieve the Contractor of any responsibility for the quality, accuracy, completeness, or compliance of the Works.

Prior to Taking-Over, the Contractor shall submit complete quality records, as-built survey information, commissioning documentation, operation and maintenance manuals, warranties, certificates of compliance, and all other documentation required under the Contract.

Concrete placement, embankment construction, foundation treatment, grouting works, installation of dam monitoring instrumentation, hydro-mechanical equipment installation, pressure testing of pipelines, and commissioning of mechanical and electrical systems shall constitute Hold Points requiring prior inspection and approval by the Employer's Agent

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C3.1.13 Samples

Materials, equipment, workmanship, finishes, and manufactured products incorporated into the Works shall conform in all respects to the approved samples, the Specifications, Drawings, and applicable standards.

The Contractor shall submit samples of materials, products, components, finishes, and workmanship to the Employer's Agent for approval in accordance with Clause 7.4 of the Conditions of Contract and any additional requirements contained in the Specifications. No material or product shall be incorporated into the Works until the relevant sample has been approved by the Employer's Agent where such approval is required.

The approval of a sample shall not relieve the Contractor of his responsibility to ensure that all materials supplied, and work executed comply fully with the Contract requirements. Approval of a sample shall not constitute acceptance of any subsequent delivery, installation, or completed work. The Employer's Agent reserves the right to obtain additional samples from deliveries to Site or from completed work and to submit such samples for testing to verify compliance with the Specifications.

Should any material, equipment, or workmanship fail to comply with the approved sample or the Specification requirements, the Employer's Agent may reject such material, equipment, or workmanship and instruct its removal and replacement at the Contractor's expense. The Contractor shall bear all costs associated with the provision, delivery, storage, testing, replacement, and disposal of samples required for approval or verification purposes.

Where specified elsewhere in the Contract, the Contractor shall construct sample panels, trial sections, trial mixes, mock-ups, or demonstration installations for approval prior to commencing the related permanent Works.

Approved samples shall be retained on Site, where practical, for comparison with materials and workmanship subsequently incorporated into the Works.

C3.1.14 Notices, Signs, Barricades and Advertisements

The Contractor shall provide, erect, maintain, relocate when required, and remove upon completion all notices, warning signs, information signs, traffic signs, barricades, fencing, safety barriers, lights, and other protective devices required under the Contract, the Occupational Health and Safety Act, applicable regulations, approved Traffic Accommodation Plans, and the Conditions of Contract.

All notices, signs, barricades and advertisements shall be subject to the prior approval of the Employer's Agent regarding their design, wording, dimensions, location, and method of installation. The Contractor shall ensure that all signage remains clearly visible, legible, clean, secure, and in good condition throughout the duration of the Works.

No advertising sign, promotional display, company branding, banner, flag, or other publicity material shall be erected on or adjacent to the Site without the prior written approval of the Employer's Agent.

The Contractor shall provide and maintain all safety signs necessary to warn the public, road users, visitors, and Site personnel of hazards associated with the Works, including excavations, blasting operations, construction traffic, restricted access areas, electrical installations, and other dangerous conditions.

The Employer's Agent may instruct the Contractor to relocate, modify, replace, or remove any sign, notice, barricade, or advertisement that is considered unsatisfactory, misleading, unsafe, visually intrusive, non-compliant with statutory requirements, or detrimental to the interests of the Employer. The Contractor shall comply immediately with any such instruction and shall not be entitled to any additional payment arising therefrom.

The Contractor shall remove all temporary notices, signs, barricades, advertising material, and supporting structures upon completion of the Works and shall reinstate all affected areas to the satisfaction of the Employer's Agent.

The costs associated with the supply, erection, maintenance, relocation, protection, and removal of notices, signs, barricades, advertisements, and associated temporary works shall be deemed to be included in the tendered rates and prices and no separate payment shall be made therefor.

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C3.1.15 Requirements for Accommodation of Traffic

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.

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.

Basic Requirements

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. 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 for temporary deviations.

The Contractor shall provide and grant access to persons whose properties fall within or adjoin the area in which he is working.

C3.1.16 Open Trenches

Trenches may not be left open during the builder's holidays, and shall be safeguarded at all times from danger to the public. Safe trench-crossings shall be provided at all intersections with accesses to properties and with public roads and paths. The length of trench left open at any one time may be restricted by the Engineer, should he consider such restriction to be in the interest of public safety.

C3.1.17 Statutory Regulations

The statutory requirement of the Occupational Health and Safety Act, Act 85 of 1993 (referred to as the Act below), and all regulations promulgated there under as well as the other relevant acts must be adhered to by the Contractor, with specific reference to the safety of all employees and the public, irrespective of whether such employees are employed by the Contractor or by his subcontractors (including local subcontractors). The Contractor, in entering into this Contract, hereby agrees with the Employer in terms of Section 37(2) of the Act, that the Contractor as an employer in its own right and in its capacity as Contractor for the execution of the Works, shall have certain obligations and that the following arrangement shall apply between the Contractor and the Employer to ensure compliance by the Contractor with the provisions of the Act, namely:-

- (a) The Contractor undertakes to acquaint the appropriate officials and the employees of the Contractor with all relevant provisions of the Act, and the regulations promulgated in terms of the Act;
- (b) The Contractor undertakes that all relevant duties, obligations and prohibitions imposed in terms of the Act and regulations will be fully complied with; and
- (c) The Contractor hereby accepts sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and regulations, and expressly absolves the Employer and the Engineer from being obliged to comply with any of the aforesaid duties, obligations and prohibitions in respect of the Works; and

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- (d) The Contractor shall be obliged to report forthwith to the Employer and the Engineer any investigation, complaint, or criminal charge which may arise as a consequence of the provisions of the Act and regulations pursuant to work performed on behalf of the Employer, and shall, on written demand, provide full details in writing of such investigation, complaint or criminal charge.
- (e) The Contractor shall sign the agreement bound into Section C1.2 of this document.

The Contractor shall comply with all the conditions of the Record of Decision in terms of Section 22(3) of the Environmental Conservation Act, 1989.

A time-related and a fixed-charge item have been provided in Schedule A of the Schedule of Quantities. The contractor shall allow for all obligations imposed by the Environmental Management Plan including the appointment of an environmental manager/control officer.

C3.1.18 Safety

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations there under, the Contractor shall at his own expense (except only where specific provision (if any) is made in the contract for the reimbursement to the Contractor in respect of particular items), provide the following:

- (a) The Principal Contractor must do a Risk assessment and compile an OHS Plan to be evaluated and approved by the Safety Agent prior to commencement of Construction.
- (b) The Contractor must ensure that regular safety meetings be held, and that the minutes of such meetings be kept in a Safety File, which must be available on site at all, times.
- (c) Provide to its Employees on the site of the works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational health and Safety Act, 1993 (Act No 85 of 1993) as amended (hereinafter referred to as the Act) at all times, and shall institute appropriate and effective measures to ensure the proper usage of such safety materials, clothing and equipment at all times;
- (d) Provide, install and maintain all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the site, as well as the general public;
- (e) Implement on the site of the works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times;
- (f) Implement all necessary measures so as to ensure compliance with the Act by all subcontractors engaged by the Contractor and their employees engaged on the works;
- (g) Full compliance with all other requirements pertaining to safety as may be specified in the Contract (Also refer to Notice to Tenderers).

The Employer and the Engineer shall be entitled, although not obliged, to make such inspections on the site as they shall deem appropriate, for the purpose of verifying the Contractor's compliance with the requirements of the Act.

For this purpose, the Contractor shall grant full access to the site of all parts of the site and shall co-operate fully in such inspections and shall make available for inspection all such documents and records as the Employer's and/or Engineer's representative may reasonably require. Where any such investigations reveal, or where it comes to the Engineer's attention that the Contractor is in any way in breach of the requirements of the Act or is failing to comply with the provisions of this clause, the Engineer shall, in accordance with the provisions of clause 5.11 of the Conditions of Contract, be entitled to suspend progress on the works or any part thereof until such time as the Contractor has demonstrated to the satisfaction of the Engineer, that such breach has been rectified.

The Contractor shall have no grounds for a claim against the Employer for extension of time and/or additional costs if the progress on the works or any part thereof is suspended by the Engineer in terms of this clause, and the Contractor shall remain fully liable in respect of the payment of penalties for late completion in

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accordance with the provisions of clause 5.13.1 of the Conditions of Contract should the Contractor fail to complete the Works on or before the specified due completion date in consequence of the suspension.

Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute grounds for the Engineer to act in terms of subclause 9.2.1 of the Conditions of Contract and for the Employer to cancel the Contract in accordance with the further provisions of the said clause 9.2.”

In addition to all above safety related requirements the Contractor shall take cognisance of the requirements of the construction regulations and OHS Specifications bound in C3.5.2 of this document.

C3.1.19 Safety Officer

OHS must be provided.

The Contractor is required to ensure compliance with the Occupational Health and Safety Act (Act 85 of 1993) and its regulations, in particular the Construction Regulations, 2014, to appoint a Health and Safety Officer for the works.

The safety officer shall have a sound knowledge of the Occupational health and Safety Act. He shall preferably have completed the Safety Management Training Course (SAMTRAC) presented by NOSA. The Contractor shall submit details of the proposed

C3.1.20 Source of Material/Borrow pit

The contractor will be held responsible for locating legal, licenced and approved sources of all materials complying with the relevant minimum requirements to be used in this contract. No separate payment shall be made for this, as all costs related thereto shall be deemed to be covered by the tendered rates.

Where possible materials manufactured or produced locally shall be procured to promote local enterprise.

C3.1.21 Photographic Record

Prior to the commencement of the work, and during the contract period, a photographic record shall be made of all existing stands and structures to be effected by the project, and forwarded to the Engineer prior to the authorisation of the first progress payment.

A payment item is included in the Schedule of Quantities to cover the Contractor's cost for compliance with the above requirements.

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C3.3 Procurement

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C3.2 ENGINEERING

C3.2.1 Design

The Employer is responsible for the design of the Permanent Works as reflected in the Contract Documents, unless otherwise stated.

The Contractor shall be responsible for the design, adequacy, safety, construction, maintenance and removal of all Temporary Works required for the execution of the Contract. The Contractor shall ensure that the Temporary Works are compatible with the Permanent Works and do not adversely affect their integrity, safety, functionality or performance.

The Contractor shall submit Temporary Works designs, calculations, drawings and method statements to the Employer's Agent for review prior to construction where required by the Specifications or where instructed by the Employer's Agent. Such review shall not relieve the Contractor of any responsibility for the adequacy or safety of the Temporary Works.

The Contractor shall provide all information, records, surveys, dimensions, coordinates and details required by the Employer's Agent for the preparation of As-Built Drawings and asset records.

C3.2.2 Employer's Design

The permanent works forming part of this Contract have been designed by the Employer and are described in the Drawings, Specifications, Bills of Quantities and other Contract Documents.

The Contractor shall execute the Works in accordance with the Employer's design and shall be responsible for the construction methods, temporary works, sequencing of construction, site establishment, quality control, health and safety compliance, and all other obligations necessary to complete the Works.

Where dimensions, levels, details or specifications are unclear or require clarification, the Contractor shall immediately notify the Engineer before proceeding with the affected work.

The Contractor shall verify all dimensions, levels and site conditions prior to construction and shall report any discrepancies to the Engineer.

Alternative designs, materials or construction methods proposed by the Tenderer may be submitted as alternative tenders, provided that:

- a) The alternative proposal fully complies with the Employer's functional, operational and performance requirements;
- b) Complete design calculations, drawings, technical specifications and supporting documentation signed by a registered Professional Engineer are submitted with the tender;
- c) The alternative design complies with all applicable South African legislation, SANS standards, Department of Water and Sanitation requirements, Dam Safety Regulations and other statutory requirements;
- d) The Employer reserves the right to accept or reject any alternative proposal without obligation to provide reasons.

Acceptance of an alternative design shall not relieve the Contractor of responsibility for the adequacy, safety, constructability and performance of such alternative design

C3.2.3 Drawings

The Contractor shall use only figured dimensions shown on the Drawings and shall not scale dimensions from the Drawings unless specifically authorised by the Employer's Agent.

Any discrepancy, omission or ambiguity identified in the Drawings shall immediately be referred to the Employer's Agent for clarification before the affected work proceeds.

The Employer's Agent shall, upon request and where necessary, provide additional dimensions, details, instructions or drawings required for the execution of the Works.

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The Contractor shall maintain a complete and up-to-date set of Contract Drawings on Site at all times.

The Contractor shall keep accurate As-Built records of all works constructed, including but not limited to:

- a) Pipelines and fittings;
- b) Valves, air valves and scour valves;
- c) Chambers and manholes;
- d) Electrical and instrumentation cabling;
- e) Ducts and sleeves;
- f) Concrete structures;
- g) Mechanical installations;
- h) Dam monitoring instrumentation;
- i) Buried services and service crossings; and
- j) Any relocated or modified infrastructure.

The location of all buried infrastructure shall be recorded by means of approved coordinates referenced to the project survey control system. Levels, offsets, chainages and other relevant information shall also be recorded where required.

The Contractor shall maintain marked-up record drawings throughout the Contract and shall submit updated As-Built information to the Employer's Agent at monthly intervals or as otherwise instructed.

The submission of complete and accurate As-Built records shall be a prerequisite for Practical Completion and the issue of the Certificate of Completion.

The Contractor shall provide all survey information, electronic data, CAD files, GIS-compatible data, calculations, test records and other information reasonably required by the Employer's Agent for the preparation of final As-Built Drawings and asset registers.

Additional construction drawings will, in terms of Clause 5.9 of the General Conditions of Contract (2015), be issued to the Contractor by the Engineer/Employer on the commencement date and from time to time as required."

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C3.4 Construction

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C3.3 PROCUREMENT

C3.3.2 Restriction of the Utilisation of Personnel in the Permanent Employment of the Contractor

The Contractor shall limit the utilisation of his permanently employed personnel to that of key personnel only on the Works, as defined below, and shall execute and complete the Works utilising a temporary workforce employed directly by the Contractor and/or by his sub-contractors, using the assistance of the labour desk that will be established for the project in consultation with the various communities that are established in proximity to the Works or which will be allocated within the development.

Without derogating from the Contractor's obligations to complete the Works within the specified time for completion in terms of clause 1.1.1.14 of GCC 2025, the numbers in each category of the Contractor's key personnel, as stated by the Contractor in Part T2 of this document, will be strictly controlled during the contract period and any increase in numbers will be subject to the prior approval of the Employer.

"Key personnel" means all contracts managers, site agents, site clerks, materials and survey technicians, quantity surveyors, trainers, supervisors, foremen, skilled plant operators, welders, shutter hands and the like, and all other personnel in the permanent employ of the Contractor or his sub-contractors who possess special skills, and/or who play key roles within the Contractor's or his subcontractor's operations.

The Engineer may at his discretion, upon receipt of a written and fully motivated application from the Contractor, and where he deems the circumstances so warrant, authorise in writing that the Contractor may utilise in the execution of the Works, workers not being his key personnel but who are in his permanent employ.

Without limiting the generality of application of this sub-clause, circumstances which may be considered by the Engineer to warrant authorisation of the use of the Contractor's permanent employees other than key personnel, include:

- a) The unavailability from local sources of sufficient numbers of temporary workers and/or sub-contractors to execute the Works provided always that the Contractor has satisfied the Engineer that he has exercised his best endeavours and taken all reasonable actions to recruit sufficient temporary workers and sub-contractors from local sources as contemplated above.
- b) The unavailability within the temporary worker pool and/or from subcontractor sources available to the Contractor in terms of the Contract, of sufficient skills necessary to execute the Works or specific portions thereof, in situations where the completion period allowed in the Contract is insufficient to facilitate the creation of the necessary skills through the provision of suitable training as contemplated in the Contract;
- c) Any other circumstances which the Engineer may deem as constituting a warrant.

C3.3.3 Provision of Temporary Workforce for the Contract

The Contractor shall employ labour from the local community through the CLO except for approved key staff in the permanent employ of the Contractor, to the maximum extent that is compatible with the requirements of Clause 4.11 of the General Conditions of Contract 2025.

Although the Contractor shall adhere to the statutory minimum wage rates, he is however at liberty to negotiate additional incentive payments based on performance.

The Occupational Health and Safety Act must be adhered to with reference to the safety of any employee employed by the Contractor.

The successful tenderer shall liaise with the Ward Councillor/Ward Committee whereby the Ward Councillor shall provide to the Contractor the following if necessary:

a) A Community Liaison Officer (CLO) for liaison with the recipient community for labour recruitment

The CLO shall attend all site and other meetings concerning the project.

- Only one CLO shall be appointed per project. If the project spans over more than one Ward, the relevant Ward Councillors shall agree on one CLO to be appointed by the Contractor. Should no agreement

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be found as envisaged, the relevant Project Manager together with the Engineer, will interview prospective appointees and in their discretion appoint such CLO.

- Notwithstanding the above, if the vastness of the project requires the use of more than one CLO, this will be permitted provided that the total monthly sum paid to all CLO's shall not exceed the amount allowed for in paragraph bill of quantities.
- Should the Contractor experience any difficulties with the community, these difficulties shall immediately be brought to the attention of the Municipality/Project Manager who shall arrange a meeting with the relevant Ward Councillor(s) and the CLO to resolve such difficulties.

The main Contractor shall ensure that any Sub-Contractor he may appoint shall adhere to these conditions but also subject to the provisos applicable to the duration of such sub-contract.

Should any of the above conditions be less favourable than any Bargaining Council Agreement or Act applicable to the Contractor, the more favourable condition will apply.

A contract of employment or subcontract should be signed between the Contractor and each of his employees or sub-contractors, as the case may be. Likewise contracts of employment must be entered into between each such sub-contractor, and each of the specific subcontractor's employees. Employment and subcontract agreements shall make clear reference to at least the following conditions.

- The minimum agreed wage rate per hour in respect of labourers;
- The agreed pay rate per unit of production where applicable;
- UIF and WCA payments;
- Minimum working hours per day;
- Start and end times of a daily shift;
- Lunch break times;
- Company policy regarding:
- Rain time
- Sickness and absenteeism
- Disciplinary matters
- Grievances
- Method and frequency of payment;
- Work clothes and safety equipment to be issued
- Labour Desk

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C3.4 CONSTRUCTION

C3.4.1 Standard Specifications

- C3.4.1.1** The Standard specification, are carried out strictly in accordance with SANS 1200 - "Standard Specification for Civil Engineering Construction" as approved by the Council of the South African National Standards.
- C3.4.1.2** For the purpose of this Contract the latest issues of the following Standard Specifications for Civil Engineering Construction, applicable at the date of tender advertisement, shall apply –

SANS 1200

A	-	PRELIMINARY AND GENERAL
AB	-	ENGINEER'S OFFICE
C	-	SITE CLEARANCE
DA	-	EARTHWORKS (SMALL WORKS)
DB	-	EARTHWORKS (PIPE TRENCHES)
G	-	CONCRETE (STRUCTURAL)
GB	-	CONCRETE (ORDINARY BUILDINGS)
L	-	MEDIUM PRESSURE PIPELINES
LD	-	SEWER
LB	-	BEDDING (PIPES)
M	-	ROADS (GENERAL)
ME	-	SUBBASE
MF	-	BASE
MH	-	ASPHALT BASE AND SURFACING
MJ	-	SEGEMENTED PAVING

C3.4.1.3 The term "project specifications" appearing in any of the SANS 1200 standardised specifications must be replaced with the terms "scope of work".

C3.4.1.4 References from, and variations and additions to the Standard Specifications and Particular Specifications are included in section **C3.4.2**.

C3.4.2 Variations and Additions to Standard and Particular Specifications

The following variations and additions to the Standard and Particular Specifications will be applicable to this Contract.

The various documents listed in section C3.4.1 shall be treated as mutually explanatory. However, should any requirement of section C3.4.2 conflict with any requirement of the Standardised Specifications or with any requirement of the Particular Specifications, then the requirement of section C3.4.2 shall prevail.

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EPWP labour intensive specification

C3.4.3.1 Labour intensive competencies of supervisory and management staff

Contractors having a CIDB contractor grading designation of 4CE and higher shall only engage supervisory and management staff in labour intensive works who have either completed, or for the period 1 April 2004 to 30 June 2006, are registered for training towards, the skills programme outlined in Table 1.

The managing principal of the contractor, namely, a sole proprietor, the senior partner, the managing director or managing member of a close corporation, as relevant, having a contractor grading designation of 1CE, 2CE, 3CE and 4CE shall have personally completed, or for the period 1 April 2004 to 30 June 2006 be registered on a skills programme for the NQF level 2. All other site supervisory staff in the employ of such contractors must have completed, or for the period 1 April 2004 to 30 June 2006 be registered on a skills programme for, the NQF level 2 unit standards or NQF level 4 unit standards.

Table 1: Skills programme for supervisory and management staff

Personnel	NQF level	Unit standard titles	Skills programme description
Team leader / supervisor	2	Apply Labour Intensive Construction Systems and Techniques to Work Activities	This unit standard must be completed, and
		Use Labour Intensive Construction Methods to Construct and Maintain Roads and Stormwater Drainage	Any one of these 3 unit standards
		Use Labour Intensive Construction Methods to Construct and Maintain Water and Sanitation Services	
		Use Labour Intensive Construction Methods to Construct, Repair and Maintain Structures	
Foreman/ supervisor	4	Implement labour Intensive Construction Systems and Techniques	This unit standard must be completed, and
		Use Labour Intensive Construction Methods to Construct and Maintain Roads and Stormwater Drainage	Any one of these 3 unit standards
		Use Labour Intensive Construction Methods to Construct and Maintain Water and Sanitation Services	
		Use Labour Intensive Construction Methods to Construct, Repair and Maintain Structures	
Site Agent / Manager (i.e. the contractor's most senior representative that is resident on the site)	5	Manage Labour Intensive Construction Processes	Skills Programme against this single unit standard

C3.4.3.2 Employment of unskilled and semi-skilled workers in labour-intensive works

C3.4.3.2.1 Requirements for the sourcing and engagement of labour

1. Unskilled and semi-skilled labour required for the execution of all labour intensive works shall be engaged strictly in accordance with prevailing legislation and SANS 1914-5, Participation of Targeted Labour.
2. The rate of pay set for the EPWP obtained from the Municipality for the use of local labour is set at a minimum of R200,00 per day.
3. Tasks established by the contractor must be such that:
 - a) the average worker completes 5 tasks per week in 40 hours or less; and,
 - b) the weakest worker completes 5 tasks per week in 55 hours or less.

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4. The contractor must revise the time taken to complete a task whenever it is established that the time taken to complete a weekly task is not within the requirements of C3.4.3.2.1.3.

5. The Contractor shall, through all available community structures, inform the local community of the labour intensive works and the employment opportunities presented thereby. Preference must be given to people with previous practical experience in construction and / or who come from households:

- a) where the head of the household has less than a primary school education;
- b) that has less than one full time person earning an income;
- c) where subsistence agriculture is the source of income.
- d) those who are not in receipt of any social security pension income

6. The Contractor shall endeavour to ensure that the expenditure on the employment of temporary workers is in the following proportions:

- a) 60 % women;
- b) 20% youth who are between the ages of 18 and 25; and
- c) 2% on persons with disabilities.

C3.4.3.3 Specific provisions pertaining to SANS 1914-5

1. Definitions

Targeted labour: Unemployed persons who are employed as local labour on the project.

2. Contract participation goals

- Is no specified contract participation goal for the contract. The contract participation goal shall be measured in the performance of the contract to enable the employment provided to targeted labour to be quantified.
- The wages and allowances used to calculate the contract participation goal shall, with respect to both time-rated and task rated workers, comprise all wages paid and any training allowance paid in respect of agreed training programmes.

C3.4.3.4 Terms and conditions for the engagement of targeted labour

Further to the provisions of clause 3.3.2 of SANS 1914-5, written contracts shall be entered into with targeted labour.

C3.4.3.5 Variations to SANS 1914-5

1. The definition for net amount shall be amended as follows:

Financial value of the contract upon completion, exclusive of any value added tax or sales tax, which the law requires the employer to pay the contractor.

2. The schedule referred to in 5.2 shall in addition reflect the status of targeted labour as women, youth and persons with disabilities and the number of days of formal training provided to targeted labour.

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C3.4.3.6 Training of targeted labour

1. The contractor shall provide all the necessary on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract in a manner that does not compromise worker health and safety.
2. The cost of the formal training of targeted labour will be funded by the provincial office of the Department of Labour. This training should take place as close to the project site as practically possible. The contractor must access this training by informing the relevant provincial office of the Department of Labour in writing, within 14 days of being awarded the contract, of the likely number of persons that will undergo training and when such training is required. The employer must be furnished with a copy of this request.
3. A copy of this training request made by the contractor to the DOL provincial office must also be faxed to the EPWP Training Director in the Department of Public Works – Cinderella Makunike, Fax Number 012 328 6820 or email cinderella.makunike@dpw.gov.za Tel: 083 677 4026.
4. The contractor shall be responsible for scheduling the training of workers and shall take all reasonable steps to ensure that each beneficiary is provided with a minimum of six (6) days of formal training if he/she is employed for 3 months or less and a minimum of ten (10) days if he/she is employed for 4 months or more.
5. The contractor shall do nothing to dissuade targeted labour from participating in training programmes.
6. An allowance equal to 100% of the task rate or daily rate shall be paid by the contractor to workers who attend formal training, in terms of C3.4.3.6.2 above.
7. Proof of compliance with the requirements of items above must be provided by the Contractor to the Employer prior to submission of the final payment certificate.

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VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

SANS 1200 A: GENERAL

PSA 1 QUALITY OF MATERIALS (Sub clause 3.1)

Add the following:

- All materials incorporated into the Works shall be new, unused, free from defects and of the highest quality suitable for their intended purpose unless otherwise specified.
- All materials for which South African National Standards (SANS) specifications exist shall comply with the latest applicable SANS requirements and shall bear the SANS mark where certification is applicable.
- Materials supplied under this Contract shall be obtained from approved manufacturers and suppliers with proven experience in the manufacture and supply of such materials.
- The Contractor shall, when requested by the Engineer, submit certificates of compliance, manufacturer's test certificates, factory quality assurance records, and any other documentation necessary to verify compliance with the Contract Specifications.
- No material shall be incorporated into the Works until it has been inspected and approved by the Engineer where such approval is required.
- The Engineer may require samples of any material to be submitted for approval prior to procurement and installation. Approval of a sample shall not relieve the Contractor of responsibility for compliance with the Contract requirements.
- The Contractor shall be responsible for the proper transportation, handling, storage and protection of all materials to prevent deterioration, contamination, damage, theft or loss. Any damaged, deteriorated or defective material shall be removed from Site and replaced at the Contractor's expense.
- Materials that do not comply with the Specifications, Drawings, SANS standards, Project Specifications, or the Engineer's requirements shall be rejected and removed from Site immediately.
- Where materials are imported or where no SANS standard exists, the materials shall comply with an internationally recognised standard acceptable to the Engineer, such as ISO, BS, ASTM, AWWA, DIN, EN or equivalent approved standard.
- The Contractor shall maintain records of the source, batch numbers, delivery dates and test certificates of all major construction materials incorporated into the Works.

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PSA 2 CONTRACTOR'S OFFICES, STORES AND SERVICES (Clause 4.2)

Add the following to the provisions of Clause 4.2.

a) Location of Facilities

The location of the Contractor's offices, workshops, stores, laydown areas, batching areas, fuel storage facilities and other temporary works shall be subject to the prior approval of the Engineer.

The Contractor shall confine all site establishment activities to the approved areas and shall not occupy additional areas without the written approval of the Engineer.

b) Site Office

The Contractor shall provide and maintain a suitably equipped site office throughout the duration of the Contract.

The site office shall:

- Be weatherproof, secure and adequately ventilated.
- Be provided with desks, chairs, tables and filing facilities.
- Include a meeting room suitable for site meetings accommodating a minimum of eight (8) persons.
- Be provided with adequate lighting and power supply.
- Be maintained in a neat and orderly condition at all times.

The Contractor shall make the meeting facility available for all contract-related meeting

c) Communication Facilities

The Contractor's designated Site Agents and Safety Officer shall each be in possession of a functioning cellular telephone throughout the Contract period.

The Contractor shall ensure that key supervisory personnel can be contacted at all times during working hours and during emergency situations.

d) Sanitary and Welfare Facilities

The Contractor shall provide and maintain adequate sanitary, washing and welfare facilities for all personnel employed on the Site in accordance with the Occupational Health and Safety Act and Construction Regulations.

All facilities shall be kept clean, hygienic and in proper working condition throughout the Contract period.

e) Water and Electricity

The Contractor shall make his own arrangements for the provision of temporary water, electricity and other services required for construction purposes.

The Contractor shall be responsible for all application fees, connection charges, consumption charges and maintenance associated with such services.

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f) Security

The Contractor shall be responsible for the security of all offices, stores, plant, materials and equipment located on Site.

The Contractor shall provide all necessary fencing, access control, lighting, security personnel and other measures required to protect the Works and associated facilities

g) Environmental Compliance

The Contractor shall ensure that all temporary facilities are established and operated in accordance with the Environmental Management Programme (EMPr) and all applicable environmental legislation.

No pollution, nuisance, excessive dust, noise or contamination of surrounding areas shall be permitted.

h) Removal Upon Completion

Upon completion of the Works, the Contractor shall remove all temporary offices, stores, workshops, services, debris and surplus materials from the Site and restore the affected areas to the satisfaction of the Engineer. No separate payment shall be made for the removal of temporary facilities.

i) Payment

No separate payment shall be made for Contractor's offices, stores, services, welfare facilities, communications, security, utilities, maintenance, removal and associated obligations.

The costs thereof shall be deemed to be included in the rates and prices tendered under the Preliminary and General Items.

PSA 3 SETTING OUT OF THE WORKS (Clause 5.1.1)

Substitute the first sentence of Clause 5.1.1 with the following:

The Engineer will provide the Contractor with available survey control information, benchmarks, coordinates, reference points and setting-out data necessary for the execution of the Works.

Add the following:

The Contractor shall be responsible for the accurate setting out of all Works from the information supplied by the Engineer and shall verify all dimensions, levels, coordinates and site conditions before commencing construction.

The Contractor shall provide all labour, equipment, survey instruments, pegs, profiles, markers and other materials necessary for setting out the Works and maintaining such setting out throughout the Contract period.

All benchmarks, survey beacons, control points and reference marks shall be carefully protected by the Contractor. Any benchmark, beacon or control point disturbed, damaged or destroyed by the Contractor shall be reinstated by a suitably qualified land surveyor at the Contractor's expense.

The Contractor shall immediately notify the Engineer of any discrepancy between the setting-out information provided and actual site conditions before proceeding with the affected work.

The checking of setting out by the Engineer shall not relieve the Contractor of responsibility for the accuracy of the setting out or for any errors therein.

Any work found to be incorrectly positioned, aligned or levelled as a result of setting-out errors shall be corrected by the Contractor at his own cost.

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Setting out the Works will not be measured and paid for separately. The costs associated with setting out, survey control, verification of levels and coordinates, maintenance of benchmarks and correction of setting-out errors shall be deemed to be included in the rates and prices tendered for the various items of work. Prior to commencement of construction, the Contractor shall establish and submit a survey control network linked to the approved project coordinates and levels. All critical structures including the weir crest, spillway crest, outlet works, pump station, pipelines and embankment works shall be surveyed and certified by a qualified surveyor before concrete placement or covering of the works.

PSA 4 WATCHING, BARRICADING, LIGHTING AND TRAFFIC CROSSINGS (Clause 5.2)

The Add the following:

The Contractor shall provide, erect, maintain and remove upon completion all temporary warning signs, barricades, cones, marker posts, drums, flagging, lights and other safety devices necessary for the protection of the Works, the public, adjacent property owners and road users.

Particular attention shall be given to maintaining safe access to all existing properties, residences, farms and services affected by the Works.

The Contractor shall ensure that construction activities do not unnecessarily obstruct existing access roads, tracks or footpaths. Where temporary closures or restrictions are unavoidable, the Contractor shall provide suitable alternative access arrangements to the satisfaction of the Engineer.

All traffic accommodation measures and warning signs shall comply with the requirements of the South African Road Traffic Signs Manual (SARTSM) and any applicable statutory requirements.

The Contractor shall employ flag personnel where required by the Engineer or where construction operations create hazards to road users or pedestrians.

The Contractor shall be responsible for the safety of construction traffic entering and leaving the Site and shall take all reasonable measures to minimise dust, excessive speed, noise and inconvenience to local residents. No separate payment shall be made for watching, barricading, lighting, temporary traffic control, warning signs, flag personnel, maintenance of access or any related obligations. The costs thereof shall be deemed to be included in the tendered rates and prices.

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PSA 5 LOCATION AND PROTECTION OF EXISTING SERVICES (Clause 5.4)

Add the following provisions of Clause 5.4.1

PSA 5.1 Location of existing services

Before underground or excavation work is carried out, the Contractor shall ascertain the presence and position of all services likely to be damaged or interfered with by his activities. He shall obtain up-to-date plans from the Engineer for this purpose, showing the position of services in the area where he intends to work.

As services can often not be reliably located from such plans, the Contractor shall determine the exact position of such services by means of suitable detecting equipment and afterwards by careful hand excavation where necessary in order to expose the services at the positions of possible interference by his activities. This procedure shall also be followed in respect of services not shown on the plans but believed to be present.

All such services, the positions of which have been located at the critical points, shall be designated as "known" services and their positions shall be indicated on a separate set of Drawings, a copy of which shall be furnished to the Engineer.

While he is occupying the Site, the Contractor shall be liable for all damage caused by him to known services as well as for consequential damage, whether caused directly by his operations or by the lack of proper protection.

PSA 6 ACCOMMODATION OF TRAFFIC (New clause 5.9)

The Contractor shall make adequate provision for the safe accommodation of all traffic affected by the Works, including construction vehicles, residents, landowners, pedestrians and service vehicles.

Temporary traffic signs shall be erected and maintained at all diversions, temporary access roads, road crossings, excavations and other locations where hazards to road users may exist.

The number, type, positioning and layout of traffic signs and traffic accommodation measures shall comply with the latest edition of the South African Road Traffic Signs Manual (SARTSM) and any requirements of the relevant road authority.

The Contractor shall maintain safe and convenient access to all affected properties throughout the Contract period. Where temporary closures are unavoidable, alternative access arrangements shall be provided to the satisfaction of the Engineer.

All temporary signs, barricades, cones, delineators, warning devices and flagging personnel shall be maintained in good condition and shall remain clearly visible at all times.

The Contractor shall ensure that construction traffic operates in a safe manner and shall implement appropriate speed control measures on site access roads and temporary diversions where directed by the Engineer.

Upon completion of the Works, all temporary traffic accommodation measures shall be removed and the affected areas restored to their original condition or better.

No separate payment shall be made for accommodation of traffic, temporary signs, barricades, flag personnel, maintenance of access roads or related traffic control measures. The costs thereof shall be deemed to be included in the tendered rates and prices.

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PSA 7 TOLERANCES

PSA 7.1 General (New subclause 6.4)

No guarantee is given that the full specified tolerances will be available independently of one another, and the Contractor is cautioned that the full use of any one tolerance may reduce or eliminate the permissible use of tolerances relating to other aspects of the Works.

Except where otherwise specified or where clearly not applicable, all quantities for measurement and payment shall be determined from the authorised dimensions. The authorised dimensions shall be the dimensions shown on the Drawings, specified in the Contract Documents, or subsequently amended by written instruction of the Engineer.

Unless otherwise specified, all measurements for payment purposes shall be based on the authorised dimensions without allowance for construction tolerances.

Where the Works have been constructed within the specified tolerances, payment shall be based on the authorised dimensions irrespective of the actual dimensions achieved.

Where the Works have not been constructed within the specified tolerances, the Engineer may, at his sole discretion, require the non-conforming work to be removed and reconstructed at the Contractor's expense, or may accept the work subject to such conditions as the Engineer may determine.

Where non-conforming work is accepted by the Engineer, no additional payment shall be made for quantities of work, materials, excavation, fill, concrete or any other item in excess of those calculated from the authorised dimensions.

Where the actual dimensions are less than the authorised dimensions less the permissible tolerance, payment shall be based on the actual dimensions measured on Site or determined from survey records, as applicable.

Acceptance of any work outside the specified tolerances shall not relieve the Contractor of responsibility for the quality, safety, performance or durability of the Works.

Any costs arising from over-excavation, excessive concrete placement, overbreak, excess fill, reworking of completed work, or correction of work constructed outside the specified tolerances shall be borne by the Contractor.

The Engineer may require survey verification of completed earthworks, concrete works, pipelines, spillways, outlet structures and other permanent works before such work is covered or incorporated into subsequent construction activities. Any work found to be outside the specified tolerances shall be corrected by the Contractor at his own expense.

PSA 9 MEASUREMENT AND PAYMENT

PSA 9.1 Contractual Requirements (sub clause 8.3.1)

Add to sub-clause 8.3.1:

"In addition, the sum tendered shall cover all initial costs incurred in complying with the requirements of the Special Conditions of Contract.

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PSA 9.2 Contractual Requirements (sub clause 8.4.1)

The Contractor shall tender a lump sum in the Schedule of Quantities to cover all time-related establishment and maintenance costs associated with the execution of the Contract.

The amount tendered and paid shall constitute full compensation for:

- i. The establishment, operation and maintenance of the Contractor's site and head office organisation insofar as it relates to the execution of this Contract.
- ii. The maintenance of all insurances, guarantees, securities, indemnities and other contractual obligations required in terms of the Conditions of Contract and Tender Documents.
- iii. Compliance with all general conditions, statutory requirements, obligations and responsibilities not measured elsewhere in the Contract Documents.
- iv. The provision and maintenance of site supervision, administration, communication systems, offices, stores, workshops, welfare facilities and temporary services required for the execution of the Works.
- v. Compliance with the Occupational Health and Safety Act, Construction Regulations, Environmental Management Programme (EMPr), quality assurance requirements and all applicable legislation.
- vi. The provision and maintenance of security measures necessary for the protection of the Works, plant, equipment, materials and personnel.
- vii. Attendance at site meetings, progress meetings, quality control meetings, health and safety meetings and all other contract administration activities.

The Contractor shall tender a lump sum for the above items.

Payment of the lump sum shall be made monthly in accordance with the provisions of Sub-Clause 8.2.2 of SANS 1200 A and the payment schedule contained in the Bill of Quantities.

No adjustment to the time-related Preliminary and General Items shall be made in respect of Special Non-Working Days stipulated in the Contract Data or Appendix to Tender. The Contractor shall be deemed to have allowed for such days in his tendered rates and prices.

No separate payment shall be made for any item falling within the scope of these time-related obligations unless specifically provided for elsewhere in the Contract.

The Contractor shall be deemed to have included in the tendered amount all costs associated with obtaining permits, maintaining records, preparing quality documentation, compiling monthly reports, providing as-built information, facilitating audits and inspections, and complying with the requirements of the Engineer, Employer, Dam Safety Office and relevant authorities.

PSA 9.3 Adjusted Payment for Time-Related Items

The payment to the Contractor for Time-Related Items shall be adjusted in accordance with the following formula in the event of the Contract being extended by means of a variation order:

Sum of Tendered amounts

for Time Related Items x $\frac{\text{Extension of Time authorised by variation order}}{\text{Tender contract period}}$

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

The abovementioned adjustment of the payment for Time-Related Items shall be made in the Completion Payment Certificate and shall be the only payment for additional Time-Related costs irrespective of the actual period required to complete the Contract including its authorised extensions.

In the case of fixed price contracts, the amount by which the Time-Related Items is adjusted shall not be subject to the Contract Price Adjustment formula.

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

PSA 9.4 Compliance with OHS Act and Regulations
(Including The Construction Regulations 2014) **unit: sum**

The tendered sum shall include full compensation to the Contractor for compliance with all the requirements of the OHS Act and Regulations (including the Construction Regulations 2014) at all times for the full duration of the Contract.

This sum will be paid to the contractor in equal monthly amounts subject to proper/substantial compliance

PSA 9.5 Accommodation of Traffic (Clause 8.8.2)

Where the new works interferes with the existing roads, the Contractor shall construct these sections of the works under traffic. The work will involve catering for the safe and easy passage of public traffic in all weather, both day and night for the full traffic control and signposting.

The Contractor may alternatively make his own arrangement for detours to be constructed, all subject to the Engineers approval.

Add the following after the first paragraph:

"All temporary road signs, devices, sequences, layouts and spacing shall comply with the requirements of the Road Traffic Act, 1996 (Act 93 of 1996), the National Road Traffic Regulations, 2000, the South African Road Traffic Signs Manual and the requirements of the relevant road authority. All temporary traffic control facilities shall also comply with the guidelines set in SA Road Traffic Signs Manual, Volume 2, Chapter 13: Road works Signing, (SARTSM, June 1999, obtainable from the Government Printer, Pretoria)"

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SANS 1200 A: PRELIMINARY AND GENERAL

PSA 3.1 Quality of Samples

All materials used in the Works shall be new, free from defects and suitable for the purpose for which they are intended.

Materials shall comply with the requirements of the relevant South African National Standards (SANS) and any other standards specified in the Contract Documents. Where no applicable SANS standard exists, materials shall comply with an internationally recognised standard acceptable to the Engineer.

The Contractor shall, when requested by the Engineer, submit samples of materials, manufacturer's literature, certificates of compliance, test certificates and other supporting documentation for approval prior to procurement or incorporation into the Works.

Approval of any sample or material by the Engineer shall not relieve the Contractor of responsibility for ensuring compliance with the Contract requirements.

The Engineer may at any time require additional samples or testing of materials to verify compliance with the Specifications. The cost of testing materials that comply with the Specifications shall be borne by the Employer unless otherwise specified. The cost of testing materials found to be non-compliant shall be borne by the Contractor.

Any material rejected by the Engineer shall be removed from Site and replaced at the Contractor's expense.

The Contractor shall ensure that all approved materials are properly stored, handled and protected against damage, contamination, deterioration and theft prior to incorporation into the Works.

Particular attention shall be given to materials incorporated into water-retaining structures, including concrete, reinforcement, structural steel, pipes, valves, geosynthetics and mechanical equipment. Such materials shall be supplied with manufacturer's certificates and quality records demonstrating compliance with the specified requirements.

PSA 5 CONSTRUCTION

PSA 5.1 Setting out of the work and protection of beacons (Sub-clause 5.1)

The Contractor shall be responsible for the accurate setting out of the Works from the control points, benchmarks and survey information shown on the Drawings or indicated by the Employer's Agent Representative on Site.

Prior to commencing any construction activities, the Contractor shall verify the correctness of all survey pegs, benchmarks, control points and setting-out information provided. Any discrepancy, omission or inconsistency identified by the Contractor shall be immediately reported to the Employer's Agent Representative for clarification before the affected work proceeds.

Failure by the Contractor to verify survey information and report discrepancies shall render the Contractor fully responsible for any costs, delays, remedial work or reconstruction arising therefrom.

The Contractor shall protect all survey beacons, benchmarks, reference pegs and control points from disturbance or damage during the execution of the Works. Any benchmark, beacon or control point disturbed, damaged or destroyed by the Contractor shall be reinstated at the Contractor's expense to the satisfaction of the Employer's Agent Representative.

The Employer's Agent Representative may instruct adjustments to the alignment, levels, dimensions or position of portions of the Works where necessary to accommodate actual site conditions or to achieve the intended design objectives.

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The checking or approval of setting out by the Employer's Agent Representative shall not relieve the Contractor of responsibility for the accuracy of the setting out.

No claim arising from incorrect setting out by the Contractor shall be considered.

Clause PS 10.6 shall also apply.

Before commencement of major earthworks, concrete works, pipelines, spillway construction or installation of mechanical equipment, the Contractor shall submit a survey control report confirming the coordinates and levels of all primary control points.

PSA 5.1.1 Services (Sub-clause 5.2)

All excavations to expose existing known services shall be excavated by hand in all materials by the contractor. Any existing service in the road reserve or municipal servitude that is damaged as a result of negligence by the contractor will be repaired by the contractor to the satisfaction of the Employer's Agent at his own cost. Clause PS 10.1 shall also apply.

PSA 5.2 Watching Barricading, lighting and traffic crossings, (Clause 5.2)

All open excavations, trenches, shafts, foundations and other hazardous areas shall be adequately protected and clearly demarcated by means of barricades, danger tape, reflective tape, warning signs, cones, lights or other approved safety devices.

The Contractor shall provide, erect, maintain and remove all temporary safety measures necessary to protect the public, employees, visitors, livestock, vehicles and adjacent property from hazards associated with the Works.

Where excavations are located adjacent to roads, access tracks, pedestrian routes or occupied properties, the Contractor shall provide additional protection measures as directed by the Employer's Agent Representative.

All warning signs, barricades and safety devices shall be maintained in a clean, visible and effective condition for the duration of the hazard.

Where required by the Employer's Agent Representative or applicable legislation, suitable warning lights or reflective devices shall be provided to ensure visibility during hours of darkness or poor visibility.

The Contractor shall comply with all applicable requirements of the Occupational Health and Safety Act, Construction Regulations, local authority requirements and the approved Health and Safety Plan.

No separate payment shall be made for watching, barricading, lighting, warning signs, temporary fencing, protection of excavations or other safety measures. The costs thereof shall be deemed to be included in the tendered rates and prices.

PSA 5.3 Protection of Structures (Clause 5.3)

The Contractor shall take all necessary precautions to protect existing buildings, structures, services, fences, roads, access tracks and other property that may be affected by the Works.

Where construction activities are to be undertaken within close proximity of occupied buildings or other structures, the Contractor shall provide written notice to the affected property owner or occupier at least fourteen (14) days prior to commencement of the work.

Before commencing work in such areas, the Contractor shall undertake a condition survey of the affected structures. The survey shall include written records, photographs and any other information necessary to

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establish the existing condition of the structures. Copies of the condition survey records shall be submitted to the Employer's Agent Representative.

Upon completion of the work in the affected area, a follow-up inspection shall be undertaken with the property owner or occupier and the Employer's Agent Representative to identify any damage that may have resulted from the Contractor's operations.

The Contractor shall immediately repair, replace or otherwise make good any damage caused to existing structures, property or services as a result of the Works, at his own cost and to the satisfaction of the Employer's Agent Representative.

The Contractor shall not use vibration-producing equipment, blasting operations or heavy compaction equipment near existing structures without the prior approval of the Employer's Agent Representative.

Clause PS 10.2 shall also apply..

PSA 5.7 Safety

Add the following:

1. Contractor shall at all times take all necessary precautions to ensure the health and safety of his employees, subcontractors, visitors, the public and all persons affected by the Works.
2. The Contractor shall comply with all applicable legislation, regulations, by-laws and statutory requirements relating to occupational health and safety, including but not limited to:
 - a. Occupational Health and Safety Act, 1993 (Act 85 of 1993)
 - b. Construction Regulations, 2014, as amended
 - c. Compensation for Occupational Injuries and Diseases Act (COIDA)
 - d. National Environmental Management Act (NEMA), where applicable
 - e. Any other legislation relevant to the execution of the Works.

The Code of Practice relating to the safety of men in civil engineering inspection pits and small – diameter vertical shafts. (Transactions of the South African Institution of Civil Engineers, Vol. 2, No. 11, November 1960, obtaining from the Secretary, S.A. Institution of Civil Engineers, PO Box 93495, Yeoville, 2143).

3. Before commencing work, the Contractor shall prepare and submit a Health and Safety Plan based on the Employer's Health and Safety Specification. No work shall commence until the Health and Safety Plan has been accepted by the Employer's Agent.
4. The Contractor shall appoint competent personnel as required by the Construction Regulations, including a Construction Manager and Safety Officer where applicable.
5. Suitable risk assessments shall be undertaken for all construction activities and shall be reviewed as work progresses.
6. The Contractor shall provide and maintain all necessary personal protective equipment (PPE) and shall ensure its correct use at all times.
7. The Contractor shall provide and maintain safe access to all parts of the Works by means of ladders, walkways, platforms, guardrails, handrails or other approved means.
8. All excavations, trenches, shafts and hazardous areas shall be adequately protected, barricaded and signposted. Trenches shall be properly supported, battered or otherwise protected against collapse.

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9. Suitable precautions shall be taken to protect persons from falling objects, moving plant, electrical hazards, confined spaces, drowning hazards, unstable ground and other construction-related risks.
10. The Contractor shall provide adequate first aid facilities, trained first aid personnel and emergency equipment on Site at all times.
11. Emergency contact details shall be prominently displayed at the Site Office and other strategic locations and shall include:
 - i. Local Police: Telephone number
 - ii. Local Ambulance: Telephone number
 - iii. Local Fire Brigade: Telephone number
 - iv. Nearest Doctor
 - v. Name
 - vi. Telephone number (office hours)
 - vii. Telephone number (after hours)
 - viii. Consulting room street address
12. All accidents, incidents and dangerous occurrences shall be reported and investigated in accordance with statutory requirements and copies of all reports shall be submitted to the Employer's Agent.
13. The Employer's Agent may instruct the Contractor to rectify unsafe conditions immediately. Such instruction shall not relieve the Contractor of any responsibility for health and safety compliance.
14. The Contractor shall comply with the Safety Instructions, Health and Safety Specification and all other safety requirements contained in the Contract Documents.
15. No separate payment shall be made for compliance with health and safety requirements. The costs thereof shall be deemed to be included in the tendered rates and prices.

The Contractor shall develop specific safe work procedures and risk assessments for excavations, work adjacent to watercourses, confined spaces, lifting operations, concrete works, dewatering activities, operation of heavy plant and work in areas subject to flooding

PSA 6.2 Degree of accuracy (Sub-clause 6.2)

The requirements relating to Degree of Accuracy shall apply to all components of the Works unless otherwise specified in the Contract Documents, Drawings, Specifications or Schedule of Quantities.

Where different tolerances may be interpreted as applying to the same element of the Works, the more stringent tolerance shall apply unless otherwise directed by the Employer's Agent.

Where specific tolerances are stated on the Drawings or in the Specifications, such tolerances shall take precedence over the general tolerances specified in SANS 1200.

Compliance with the specified tolerances shall not relieve the Contractor of the responsibility to achieve the intended functionality, performance, safety and durability of the Works.

No additional payment shall be made for achieving the specified tolerances, and all costs associated therewith shall be deemed to be included in the tendered rates and prices.

The levels of weir crests, spillway crests, outlet structures, pipe inverts, pump station floors and other hydraulic control structures shall be constructed within the tolerances specified on the Drawings. Where no tolerance is specified, a maximum deviation of ± 10 mm shall apply unless otherwise approved by the Employer's Agent.

PSA 7 Testing (Sub-clause 7)

The Contractor shall be fully responsible for producing work that complies with the requirements of the Specifications, Drawings and Contract Documents in respect of quality, workmanship, dimensions, levels and tolerances.

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The Contractor shall establish and maintain an effective quality control system for the duration of the Contract and shall provide suitably qualified Engineers, Supervisors, Surveyors, Geotechnical Engineer and other personnel together with all instruments, equipment and facilities necessary for the proper control of the Works.

The Contractor shall prepare and implement a Quality Control Plan detailing the inspection, testing and monitoring procedures to be used during construction.

The cost of all supervision, inspections, process control, quality control testing, survey verification, sampling, reporting and associated activities undertaken by the Contractor shall be deemed to be included in the tendered rates and prices for the various items of work.

The Contractor's attention is drawn to the minimum testing frequencies specified elsewhere in the Contract Documents. These frequencies shall be regarded as minimum requirements only, and the Contractor shall increase the frequency of testing whenever necessary to ensure compliance with the Specifications.

All testing shall be undertaken using approved procedures and, where applicable, by laboratories acceptable to the Employer's Agent.

The Contractor shall submit copies of all test results, inspection records, survey records, level books, quality control reports and certificates of compliance to the Employer's Agent promptly after completion of the relevant work and before the work is covered or incorporated into subsequent activities.

The Employer's Agent may require additional testing where there is reason to doubt the quality of the work or where test results indicate possible non-compliance.

Where any material, workmanship or completed work fails to comply with the Specifications, all costs associated with additional investigations, testing, removal, replacement, remedial works and re-testing shall be borne by the Contractor.

Acceptance of any test results by the Employer's Agent shall not relieve the Contractor of responsibility for the quality and performance of the Works.

No separate payment shall be made for quality control, supervision, process control testing, survey verification, quality reporting or related activities.

PSA 7.2 Laboratory (Sub-clause 5.2)

The Contractor shall establish, equip, staff and maintain a suitably equipped site laboratory for the duration of the Contract.

The laboratory shall be under the control of a qualified Materials Engineer or Senior Materials Technician and shall be capable of undertaking routine quality control testing required for the Works.

The laboratory shall be equipped to perform, as a minimum:

- a. Soil classification testing
- b. Moisture content determination
- c. Compaction control testing
- d. Aggregate grading tests

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- e. Concrete slump testing
- f. Concrete cube preparation and curing
- g. Concrete temperature monitoring
- h. Survey verification support

Any other routine testing required by the Contract Specifications

The Contractor shall additionally appoint a SANAS-accredited commercial laboratory approved by the Employer's Agent Representative to undertake verification and acceptance testing as specified in the Contract.

The Employer's Agent Representative shall have unrestricted access to the laboratory, testing records, equipment and personnel at all reasonable times.

Payment

Item	Description	Unit
C20.1.2.2	Employer's contribution to other special tests	
(a)	Provision for an independent site/commercial laboratory for the Employer's Agent's acceptance control	prime cost
(i)	Handling costs and profit in respect of item C20.1.2.2(a)	percentage (%)

The Prime Cost provided to cover the cost of special tests as requested by the Engineer in terms of Clause A20.1.3.6b) shall be expended in accordance with the provisions of the Conditions of contract. Payment will not be made for any special test should the test indicate that the specifications have not been complied with.

Item	Description	Unit
C20.1.5	Financial contribution for an independent site/commercial laboratory	month

The unit of measurement shall be the month.

The monthly contribution by the Contractor shall be a negative amount for all process control testing, excluding acceptance control and other testing ordered by the Engineer, as provided in the Contract Documentation.

This shall cover the Contractor's contribution towards the establishment and operation of services provided by an independent laboratory over the contract period including any approved extension of time and shall be deducted from the Contractor's interim payment certificates. However, excluded from the tendered contribution shall be the cost of all other special tests requested by the Engineer.

Note:

Providing testing equipment for use by the Engineer.

Except for the equipment listed in item C20.1.3.1, this specification does not envisage the provision of testing equipment by the Contractor for the use of the Engineer but where necessary provision shall be made therefore in the Contract Documentation and the relevant pay items shall be described.

PSA 7.4 Statistical analysis of control tests (Sub-Clause 7.4)

Statistical control methods will not be applied under this contract.

PSA 8 MEASUREMENT AND PAYMENT

PSA 8.2.1 Fixed-Charge and Value-Related Items (Sub-clauses 8.2.1. and 8.3)

The tendered sums for the fixed-charge and value-related items in the Preliminary and General Section of the Schedule of Quantities shall constitute full compensation for the obligations described in the relevant item descriptions.

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Subject to the provisions of the General Conditions of Contract, the tendered amounts for fixed-charge and value-related items shall not be adjusted solely as a result of variations in the final value of the Works within the limits contemplated by the Contract.

Payment of fixed-charge items shall be made as follows:

- (a) 40% upon establishment of the Site, completion of site facilities, submission of the required insurances, guarantees, Health and Safety documentation and commencement of construction activities to the satisfaction of the Employer's Agent;
- (b) 40% when approximately 50% of the Contract Price excluding contingencies, price adjustments and materials on Site has been certified for payment;
- (c) 20% upon issue of the Practical Completion Certificate.

Time-related Preliminary and General items shall be paid monthly in accordance with the provisions of SANS 1200 A and the Schedule of Quantities.

No separate payment shall be made for obligations that are deemed to be included in the fixed-charge and value-related items.

PSA 8.2.2 Time-Related Items

The tendered amount for a time-related item shall constitute full compensation for maintaining the relevant resources, facilities, personnel, services and obligations for the duration of the Contract.

Where an extension of time is granted under the Contract and the Contractor is entitled to additional payment in accordance with the Conditions of Contract, the amount payable for the affected time-related item shall be adjusted, provided that the activity, resource or obligation represented by the item is required to be maintained during the extended period.

The adjustment shall be based on the ratio between:

- (a) the period of extension for which compensation is payable; and
- (b) the original period allowed for completion of the Works.

No adjustment shall be made for activities, resources or obligations that are no longer required during the extended period.

Where the Contractor completes the Works before expiry of the original Contract period, the amount payable for time-related items that are demonstrably affected by the reduced construction period may be adjusted proportionately.

No adjustment shall be made to fixed-charge items or value-related items as a result of changes to the Contract period unless specifically provided for elsewhere in the Contract.

The Contractor shall provide substantiation of all resources, personnel, facilities and services maintained during any extended period where adjustment of time-related items is claimed. The Employer's Agent may require supporting records, payroll information, plant records, laboratory staffing records, security records and other evidence to verify entitlement.

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PSA 8.2.2.1 Standing time costs due to riot, etc. for the Contractor's total operation.

The unit for measurement shall be a working day, and a working week shall be held to consist of five working days and a working day of 9 hours, unless otherwise agreed upon. The sum per working day tendered under this time-related item shall represent that part of the Contractor's costs for standing time of whatever nature.

This payment item will only be applicable to delays in the execution of the Works and additional costs which in the opinion of the Employer's Agent are incurred as a result of riot, commotion, politically motivated sabotage and acts of terrorism, or disorder outside the control of the Contractor.

The provision of this clause shall in no way prejudice the right of the Employer or the Contractor to terminate the Contract under the provisions of Clause 9 of the GCC (2025).

PSA 8.3.2.1 Facilities for Employer's Agent

The Contractor to provide one furnished site offices for the use of the Employer's Agent and his representative to the requirements of SANS 1200 AB 3.2 or similar approved. A monthly time-related provisional sum has been included in the Schedule of Quantities to cover the rental costs of accommodation for the Employer's Agent Representative. These amounts shall be payable by the Contractor to the Employer's Agent according to the provisional sums allowed and upon receipt of a tax invoice for such amounts.

The Contractor shall provide, install, maintain and continuously service reliable internet connectivity (Wi-Fi) within the Employer's Agent's site offices and boardroom facilities for the duration of the Contract. The internet service shall provide sufficient bandwidth and coverage to support project administration, online meetings, electronic document management, email communications, cloud-based project systems and other project-related activities.

In addition, the Contractor shall provide and maintain a multifunction colour printer/copier/scanner capable of printing, copying and scanning both A4 and A3 size documents. The printer shall be located within the Employer's Agent's office and shall remain fully operational throughout the Contract period. The Contractor shall be responsible for the supply and replacement of all consumables, including paper, toner cartridges, drums and other necessary materials, as well as routine servicing, maintenance and repairs.

The Contractor shall ensure that the internet and printing facilities are available at all times during normal working hours and shall promptly rectify any interruptions or equipment failures. The cost of providing, operating, servicing, maintaining and removing these facilities upon completion of the Works shall be deemed to be included in the Contractor's tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities

a) Covered Parking (Carport) Facilities

The Contractor shall provide, maintain and subsequently remove upon completion of the Works, a covered parking facility comprising a minimum of ten (10) vehicle parking bays for the exclusive use of the Employer, Employer's Agent, Engineer and authorised project personnel.

The carport structure shall be of adequate size and strength to accommodate standard passenger and light commercial vehicles and shall be provided with a durable, waterproof roof covering capable of protecting vehicles from rain, sun and other weather conditions.

The parking area shall be located adjacent to the Employer's Agent's site offices and shall be readily accessible throughout the Contract period.

The parking surface beneath the carports shall consist of compacted crushed aggregate, gravel wearing course, concrete paving, interlocking paving blocks or other approved surfacing designed to prevent the formation of dust, mud and standing water. The surface shall be maintained in a neat, safe and serviceable condition at all times.

The Contractor shall ensure that the parking area is adequately drained and maintained free of potholes, erosion, excessive dust, ponding water and other conditions that may impede access or damage vehicles.

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The cost of providing, maintaining, servicing and removing the carport facilities, including all foundations, surfacing, drainage, signage and ancillary works, shall be deemed to be included in the Contractor's tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities.

b) Boardroom and Meeting Facilities

The Contractor shall provide, furnish, equip and maintain a dedicated boardroom facility for the duration of the Contract for use by the Employer, Employer's Agent, Engineer and other authorised project stakeholders.

The boardroom shall be capable of accommodating a minimum of twenty-five (25) persons and shall be equipped with suitable tables and chairs in good condition. The facility shall be weatherproof, secure, adequately ventilated, illuminated and maintained in a clean and orderly condition at all times.

The boardroom shall be provided with adequate electrical power outlets, lighting, and internet connectivity where available. The Contractor shall also provide and maintain a whiteboard, notice board and projector screen or equivalent presentation facility for project meetings.

The boardroom shall be available for site meetings, progress meetings, technical workshops, safety meetings and other project-related meetings as directed by the Employer's Agent.

The cost of providing, furnishing, servicing, cleaning, maintaining and removing the boardroom facility upon completion of the Works shall be deemed to be included in the tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities.

Unit: Item (Sum)

c) Engineer's Ablution and Sanitary Facilities

The Contractor shall provide, service, clean and maintain dedicated ablution and sanitary facilities for the exclusive use of the Employer, Employer's Agent, Engineer and authorised project personnel for the duration of the Contract.

The facilities shall be located adjacent to, or within reasonable proximity of, the site offices and boardroom facilities and shall be readily accessible at all times.

As a minimum, the facilities shall comprise:

- Separate male and female toilet facilities where required;
- Flush toilets connected to an approved sewer system where available, or approved chemical toilets where sewer connections are not available;
- Hand-washing basins with running water or approved alternatives;
- Soap dispensers and paper towels or hand-drying facilities;
- Adequate lighting and ventilation;
- Regular cleaning and servicing;
- Provision of consumables including toilet paper, soap and sanitising materials.

All facilities shall comply with the requirements of the Occupational Health and Safety Act, Construction Regulations, and applicable local authority requirements.

The Contractor shall ensure that the facilities remain hygienic, functional and in good condition throughout the Contract period.

The cost of providing, servicing, cleaning, maintaining and removing the facilities upon completion of the Works shall be deemed to be included in the tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities.

d) Cellular Telephone

No cellular telephone has to be provided for the Employer's Agent Representative for the duration of the

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contract. Measurement and payment shall only be made for the relevant time related item. The

e) Name Board

Number of name boards as per Bill of Quantity will be ordered by the Contractor according to the Employer's Agent's specifications, complete with dimensions, wording and specifications as prescribed, within one month from the commencement date. The Contractor shall be responsible to transport the name board to site and to erect it at the indicated position on suitable supporting posts. The Contractor shall remove the name board completely from site after construction is completed before the last payment certificate shall be approved.

PSA 8.4.2 Operation and Maintenance of facilities on site for the duration of construction, except where otherwise stated

The tendered sums for the fixed-charge and value related items in the P&G Section of the Schedule of Quantities would not be subject to any variation if the actual value of the work done exceeds or falls short of the accepted tendered amount within the limit stated in Clause 6.11 of the General Conditions of Contract (2025).

PSA 8.4.2.1 Facilities for Employer's Agent (Time Related Items)

a) Cellular Telephone

No cellular telephone has to be provided for the duration of the contract. However, the contractor is responsible for costs up to R5000.00/month all-inclusive.

b) Name boards

Name boards shall be maintained for the duration of the Contract.

c) Survey Assistants and Materials

The contractor shall provide the following survey equipment on the site from the commencement to the completion of the works, which shall also be for the use of the Employer's Agent and his representatives.

a) 1 x 100m steel measuring tape;

b) Steel pegs, shovels, picks etc. which the Engineers Representative may require during the contract;

c) 1 Theodolite with tripod and 5m staff.

d) One complete Troxler test unit, with proof of recent calibration.

a. Hotel or other Accommodation or office required for the Employer's Agent Representative.

These items will include the cost of rented office accommodation and the provision of telecommunication facilities to the Employer's Agent..

d) Administrative assistance to the Contractor

This item will entail the pension of administrative assistance to the Contractor by the Employer's Agent and will include assistance relating to the:

- Calculation and determination of project quantities;
- Compilation of construction payment certificates; and
- Copy and submission of construction payment certificate.

e) Health and Safety Inspections on Site

The Contractor shall facilitate and participate in all health and safety inspections conducted on the Site by the Employer, Employer's Agent, Engineer, Construction Health and Safety Agent, Department of Employment and Labour, Dam Safety Officials, Environmental Control Officer, or any other authorised regulatory authority.

The Contractor shall provide safe access to all areas of the Works and shall ensure that a competent Health and Safety Officer or designated representative accompanies inspection teams during such inspections. The Contractor shall make available all relevant health and safety documentation, including but not limited to the approved Health and Safety Plan, risk assessments, method statements, incident records, toolbox talk records, medical certificates, plant inspection records, permits and registers required under the Occupational Health and Safety Act and Construction Regulations.

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Any non-conformances, observations or corrective actions identified during inspections shall be recorded and promptly addressed by the Contractor within the timeframes specified by the Employer's Agent or relevant authority. The Contractor shall submit written evidence of corrective actions taken and shall ensure that all identified hazards are adequately mitigated.

The Contractor shall cooperate fully with all inspection activities and shall not be entitled to any additional payment or extension of time arising from routine health and safety inspections or from the implementation of corrective measures required to achieve compliance. The cost of facilitating inspections, providing access, accompanying inspectors, maintaining records and implementing corrective actions shall be deemed to be included in the Contractor's tendered rates and no separate payment shall be made.

f) Environmental Management Plan Audits

The Contractor shall facilitate and participate in all Environmental Management Programme (EMPr) audits, inspections and compliance assessments undertaken during the Contract period by the Employer, Employer's Agent, Environmental Control Officer (ECO), environmental specialists, regulatory authorities, Dam Safety Officials or any other authorised representatives.

The Contractor shall ensure full compliance with the approved Environmental Authorisation, Environmental Management Programme (EMPr), Water Use Licence conditions, permit requirements and all applicable environmental legislation. The Contractor shall provide unrestricted access to all areas of the Works and shall make available all environmental records, monitoring reports, registers, permits, method statements, waste disposal records, rehabilitation records, incident reports and any other documentation required for audit purposes.

The Contractor shall designate a competent Environmental Officer or responsible representative to accompany auditors and inspectors during all site inspections and audits. Any environmental non-conformances, observations, complaints or corrective actions identified during audits shall be recorded and addressed within the timeframes specified by the Employer's Agent, Environmental Control Officer or relevant authority.

The Contractor shall submit written evidence of all corrective and preventative actions implemented and shall ensure that all environmental deficiencies are rectified to the satisfaction of the Employer's Agent and the Environmental Control Officer. Repeat non-conformances may result in the implementation of contractual remedies in accordance with the Conditions of Contract.

The Contractor shall not be entitled to any additional payment or extension of time arising from routine environmental audits, inspections, monitoring activities or the implementation of corrective actions necessary to achieve environmental compliance. The cost of facilitating audits, maintaining environmental records, providing access, accompanying auditors and implementing corrective measures shall be deemed to be included in the Contractor's tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities.

PSA 9.1 Submit detail as-built drawings of existing services and adjustments to construction drawings

The contractor will be responsible for the submission of all as-built drawings of all existing services intersecting pipeline trenches as well as any applicable adjustments to the construction drawings. The lump sum tendered shall include full compensation for all information in the possession of the contractor as required above in order to complete the as-built drawings must be submitted to the Employer's Agent Representative before a certificate of completion will be issued for the works.

PSA 9.2 Detailed setting out of the work

The contractor will ensure that all the works be set out from existing survey beacons by a registered surveyor. The sum tendered shall be regarded as inclusive of all related survey work on site.

The Employer's Agent will provide survey beacons (of adequate type and in sufficient quantity) as bench marks. From information provided on drawings issued by the Employer's Agent, the Contractor shall be responsible to provide all positions and levels, of all intermediate points required for proper control of the works.

As bench marks may be disturbed during the execution of the works, all levels and setting out pegs shall be

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referred to at least two bench marks. The contractor will ensure that all works are set out from existing survey beacons by a professional registered land surveyor. The setting out data, including the elevation (obtain x, y, z coordinates) from these pegs shall be submitted to the Employer's Agent evaluate final natural ground levels (NGL) prior to the commencement of excavations. In the case of deviation from the original pipe route for whatever reason, the contractor will at his own cost survey the new proposed route, and submit the data to the Employer's Agent for approval.

Preservation and replacement of beacons and pegs will be subject to the Land Survey Act, 1927 (Act No 9 of 1927).

PSA 9.3 Compile and submit Health and Safety Plan

The Contractor shall prepare, compile, submit, implement and maintain a comprehensive Health and Safety Plan for the Works in accordance with the Occupational Health and Safety Act (Act 85 of 1993), the Construction Regulations, 2014, and all other applicable legislation and project-specific health and safety requirements.

The Health and Safety Plan shall be based on the Health and Safety Specification provided by the Employer and shall address all activities associated with the construction of the Works, including but not limited to dam construction, excavation, blasting, working at heights, confined spaces, construction traffic, operation of plant and equipment, electrical installations, lifting operations, concrete works, pipeline construction, environmental hazards and work in or near watercourses.

The Contractor shall submit the Health and Safety Plan, together with all supporting documentation, to the Employer's Agent and Construction Health and Safety Agent for review and acceptance prior to commencement of any construction activities on Site. No work shall commence until the Health and Safety Plan has been accepted.

The Contractor shall review and update the Health and Safety Plan as necessary throughout the duration of the Contract to reflect changes in construction activities, risks, legislation or site conditions. Updated plans and revised risk assessments shall be submitted to the Employer's Agent and Construction Health and Safety Agent for review and acceptance.

The Contractor shall ensure that all employees, subcontractors and visitors are made aware of and comply with the approved Health and Safety Plan. Copies of the latest approved Health and Safety Plan shall be kept on Site and made available for inspection at all times.

The cost of preparing, submitting, updating, implementing and maintaining the Health and Safety Plan, including all associated risk assessments, method statements, legal appointments, training, monitoring and compliance activities, shall be deemed to be included in the Contractor's tendered rates and no separate payment shall be made unless otherwise provided for in the Bill of Quantities

PSA 9.4 Implement Health & Safety Plan

The lump sum tendered shall include full compensation for the compliance with the approved H&S Plan

and inter alia for the following:

- Provision and maintenance of Health & Safety File;
- Provision of construction supervisors and safety officers;
- Health and Safety training for employees and subs;
- Provision of protective clothing;
- Provision of safety fences, signs and barricades; and
- Scheduling of monthly safety meetings and providing monthly reports accordingly, etc.

PSA 9.6 Control of Water

The Contractors are warned that the water table might be high due to the location of the construction site, fact that this site is situated in a high rainfall area and considering that the construction period may run into rainy season.

The Contractor shall at all times and in all respects be responsible for the handling of stormwater from

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higher-laying areas above the Works and for the handling of any sub-surface water especially in excavations for terraces and trenches that may affect the Works and for the handling of all spoiled water when disconnecting existing water connections or valves. All payments to be made in this regard and all costs related thereto, shall be deemed to be included in the relevant items that are included in the Schedule of Quantities.

SANS 1200 AB: ENGINEER'S OFFICE

PSAB 1 NAMEBOARDS (Clause 3.1)

Substitute the first paragraph of Clause 3.1 with the following:

The Contractor shall supply, erect, maintain and remove upon completion one project nameboard at a location approved by the Employer's Agent.

The nameboard shall comply with the Municipality's standard requirements regarding dimensions, layout, colours, logos, lettering and content. A sample drawing is included in the Contract Documents.

The Contractor shall maintain the nameboard in a clean and legible condition throughout the Contract period and shall replace any damaged or vandalised components at his own cost.

The cost of supplying, erecting, maintaining and removing the nameboard shall be deemed to be included in the tendered rates and prices.

PSAB 2 SURVEY ASSISTANTS (Clause 5.5)

Substitute "two or more suitable educated survey labourers" with:

"one semi-skilled labourer acceptable to the Employer's Agent."

- The Contractor shall make available one semi-skilled labourer when reasonably required by the Employer's Agent to assist with survey work, testing, inspections and related quality control activities.
- The labourer shall be available at times agreed with the Employer's Agent and shall be capable of carrying out duties associated with surveying, measurement, testing and inspection activities.
- The cost of providing such assistance shall be deemed to be included in the tendered rates and prices unless otherwise provided for in the Bill of Quantities.

PSAB 3 SURVEY EQUIPMENT

The Contractor shall provide and maintain all survey equipment necessary for the accurate setting out, control and verification of the Works.

The Contractor shall, as a minimum, maintain on Site:

- a) One automatic level with tripod;
- b) One metric levelling staff;
- c) One 5 m tape measure;
- d) One 30 m tape measure;
- e) Suitable survey pegs, markers and accessories required for setting out and control of the Works.

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Where required by the Employer's Agent for verification purposes, the Contractor shall make the above equipment available for reasonable use by the Employer's Agent's staff.

The Contractor shall be responsible for the maintenance, calibration, insurance and replacement of the equipment and shall indemnify the Employer and Employer's Agent against loss or damage arising from its use.

The Contractor shall additionally provide access to qualified survey personnel and survey instruments, including total stations and GPS equipment where necessary, for the execution and verification of the Works

PSAB 4 MEASUREMENT AND PAYMENT

PSAB 4.1 Survey Assistant ((New Clause))

Payment for the survey assistant shall be at the tendered day work rates for the hours worked in assisting the Engineer's Representative. No payment shall be made for the survey equipment all costs shall be deemed to be covered by the rates tendered for the Contractor's facilities. No payment shall be made for the survey equipment or survey assistant and all costs shall be deemed to be covered by the rates tendered for the Contractor's facilities.

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SANS 1200 C: SITE CLEARANCE

PSC 1 SCOPE (Clause 1.1)

Add the following:

The specification shall also cover the demolition and removal of existing structures, foundations, pipe culverts, pipelines, fences, gates, abandoned services, road surfacing, layerworks, concrete structures and any other obstructions encountered within the Works area.

PSC 2 MATERIALS

Disposal of Material (Subclause 3.1)

Delete the first two sentences of this clause and replace with:

Debris arising from clearing operations or from the demolition of existing structures that are not suitable for re-use in the works or for landscaping in areas designated by the Engineer, shall be removed by the Contractor and disposed of at the approved tip site. Transport of such material shall not be paid separately but shall be included in the relevant items for clearing.

No material shall be disposed of within the reservoir basin, watercourses, wetlands, borrow areas or environmentally sensitive areas unless specifically approved by the Employer's Agent and Environmental Control Officer

The rates tendered shall allow for any fees to be paid at the tip site."

PSC 3 PROTECTION OF EXISTING VEGETATION

Trees, vegetation and environmentally sensitive areas designated to remain shall be protected against damage during construction.

No clearing shall be undertaken outside the approved construction footprint without the prior approval of the Employer's Agent and Environmental Control Officer.

Any damage caused by the Contractor to vegetation designated for preservation shall be rehabilitated at the Contractor's expense.

PSC 4 REMOVAL AND STOCKPIILING OF TOPSOIL

Topsoil shall be stripped from all areas affected by construction activities, including the dam basin, embankment footprint, spillway area, access roads, borrow areas, stockpile areas and building platforms.

Topsoil shall be stockpiled separately from other excavated material and protected against erosion, contamination and excessive compaction.

Stockpiled topsoil shall be reused for rehabilitation and landscaping purposes unless otherwise directed by the Employer's Agent

PSC 5 CLEARING OF OFF CHANNEL STORAGE DAM

Prior to impoundment, all vegetation, debris, refuse, organic material, structures and other unsuitable material within the area to be inundated shall be removed to the limits shown on the Drawings or directed by the Employer's Agent.

The extent of clearing required within the reservoir basin shall be subject to approval by the Employer's Agent and Environmental Control Officer.

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No separate payment shall be made unless specifically provided for in the Bill of Quantities.

PSC 6 CLEARING OF WEIR FOOTPRINT

The Contractor shall clear and grub all vegetation, topsoil, debris, unsuitable material, existing structures and obstructions within the footprint of the abstraction weir, spillway, energy dissipation structures, cofferdams, temporary diversion works and associated construction areas.

The limits of clearing shall be as shown on the Drawings or as directed by the Employer's Agent.

All cleared material shall be disposed of at approved disposal sites unless otherwise directed by the Employer's Agent.

No separate payment shall be made unless specifically provided for in the Bill of Quantities.

PSC 7 REMOVAL OF ALIEN INVASIVE VEGETATION

The Contractor shall remove and dispose of all declared alien invasive vegetation occurring within the construction footprint where indicated on the Drawings or instructed by the Employer's Agent.

The removal and disposal of alien invasive vegetation shall be carried out in accordance with the Environmental Management Programme (EMPr) and applicable environmental legislation.

No separate payment shall be made unless specifically provided for in the Bill of Quantities.

PSC 8 HERITAGE, ARCHAEOLOGICAL AND PALAEOLOGICAL FINDS

Should any archaeological artefacts, graves, fossils, historical structures, cultural resources or items of heritage significance be discovered during clearing operations, all work in the immediate vicinity shall cease immediately.

The Contractor shall protect the discovery from disturbance and immediately notify the Employer's Agent and Environmental Control Officer.

Work shall not recommence in the affected area until authorisation is received from the relevant authority.

No additional payment shall be made for compliance with this requirement.

PSC 9 FENCES AND GATES

Existing fences and gates affected by the Works shall be carefully removed, stored and reinstated, or replaced where damaged, to the satisfaction of the landowner and Employer's Agent.

PSC 10 MEASUREMENT AND PAYMENT

PSC 10.1 Clear and Grub (sub - clause 8.2.1)

The unit of measurement for clearing and grubbing of reservoir basins, dam embankments, weir footprints, building platforms, borrow areas and access roads shall be the square metre (m²).

The unit of measurement for clearing along pipeline servitudes shall be the metre (m) or square metre (m²), as specified in the Bill of Quantities.

The tendered rates shall include full compensation for clearing, grubbing, loading, haulage, stockpiling, disposal, rehabilitation and all associated operations.

The location of disposal or dumping sites shall be the Contractor's responsibility and no overhaul shall be payable to the Contractor for loading, temporary and dumping of material thus cleared under this scheduled item.

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SANS 1200 D: EARTHWORKS

PSD 1 CLASSIFICATION FOR EXCAVATION PURPOSES (Clause 3.1)

Delete Sub-Clause 3.1.1 and 3.1.2 and replace with the following:

PSD 1.1 Method of Classifying

The Contractor may employ any method of excavation he considers suitable. The method of excavation used shall not determine the classification of excavation for measurement and payment purposes.

The Employer's Agent shall determine the classification of material based on visual inspection, geological conditions encountered and the criteria specified below.

The Engineer or his Representative will decide on the classification of materials. In the first instance classification will be based on inspection of the material to be excavated and on the criteria given in PSDA 1.2 (a) and (c).

PSD 1.2 Classes of Excavation

All excavation for foundations, pipelines, structures, roads, channels, spillways, borrow areas and any other purpose under this Contract shall be classified as follows:

(a) Soft Excavation

Soft excavation shall comprise all material that can be excavated efficiently using conventional earthmoving equipment including bulldozers, excavators, loaders and backhoes without the use of ripping, hydraulic breakers or blasting.

(b) Intermediate Excavation

Intermediate excavation shall comprise material requiring heavy-duty ripping or hydraulic breaking but which does not qualify as hard rock excavation.

Intermediate excavation shall include partially weathered rock, hardpan, cemented gravel, decomposed rock and similar materials.

(c) Hard rock excavation

Hard rock excavation shall comprise material which cannot be excavated economically without blasting, wedging and splitting, or continuous hydraulic hammering.

Hard rock excavation shall include:

- Solid unweathered rock occurring in bulk.
- Rock ledges exceeding 200 mm in thickness.
- Igneous intrusions.
- Cemented sedimentary rock formations.
- Individual boulders exceeding 0.17 m³ in volume.

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PSD2 CONSTRUCTION

PSD2.1 Conservation of Topsoil (5.2.1.2)

Add the following to Subclause 5.2.1.2:

Topsoil shall be stripped from all areas affected by the Works, including the dam basin, embankment footprint, spillway areas, access roads, borrow areas, stockpile areas and building platforms.

Topsoil stockpiles shall not exceed 2.0 m in height and shall be protected against erosion, contamination and excessive compaction.

No vehicles shall be permitted to travel over stockpiled topsoil.

Topsoil shall be retained for rehabilitation and landscaping purposes unless otherwise directed by the Employer's Agent.

PSD 3 BORROW AREAS

Borrow areas shall only be developed in locations approved by the Employer's Agent and Environmental Control Officer.

- Topsoil shall be stripped and stockpiled separately before excavation commences.
- Borrow areas shall be rehabilitated upon completion of use in accordance with the Environmental Management Programme.
- No material shall be obtained from unauthorised areas.

PSD 4 DEWATERING OF EXCAVATIONS

The Contractor shall provide all labour, materials, plant and equipment required for dewatering excavations and maintaining excavations in a dry and stable condition until the permanent works have been completed. The Contractor shall ensure that dewatering activities do not adversely affect adjacent structures, roads, services, watercourses or environmentally sensitive areas.

No separate payment shall be made for dewatering unless specifically provided for in the Bill of Quantities.

PSD 5 FOUNDATION PREPARATION

All foundations for dams, weirs, spillways, pump stations, valve chambers and other structures shall be excavated, cleaned and prepared to the lines and levels shown on the Drawings.

Foundation surfaces shall be inspected and approved by the Employer's Agent before construction proceeds. Loose, weathered, soft or otherwise unsuitable material shall be removed to the satisfaction of the Employer's Agent.

PSD 6 UNSUITABLE MATERIAL

Any unsuitable material encountered below formation level or foundation level shall be removed and replaced with approved material as directed by the Employer's Agent.

The extent of unsuitable material shall be agreed upon before removal commences.

PSD 7 COMPACTION REQUIREMENTS

All fill material shall be placed in uniform layers and compacted to the densities specified in the Contract Documents.

Compaction testing shall be carried out at the frequencies specified in the Quality Control Plan and relevant sections of the Specifications.

Areas failing to achieve the specified density shall be reworked and retested at the Contractor's expense.

PSD 8 EARTHWORKS FOR ACCESS ROADS

Road formations shall be excavated, shaped, compacted and finished to the lines, levels, gradients and crossfalls shown on the Drawings.

Soft areas identified during construction shall be removed and replaced with approved material.

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Completed roadbed layers shall be proof rolled in the presence of the Employer's Agent.

PSD 9 PROTECTION OF EXCAVATIONS

The Contractor shall take all necessary precautions to prevent collapse, erosion, flooding or deterioration of excavations.

Excavations shall be adequately drained, supported, battered or otherwise protected.

Any damage arising from inadequate protection shall be rectified by the Contractor at his own cost.

PSD 10 MEASUREMENT AND PAYMENT

No separate payment shall be made for:

- Dewatering.
- Protection of excavations.
- Foundation cleaning.
- Stockpiling of topsoil.
- Proof rolling.
- Temporary drainage.
- Rehabilitation of borrow areas.

The costs thereof shall be deemed to be included in the tendered rates and prices unless specifically measured elsewhere in the Bill of Quantities.

SANS 1200 DB: EARTHWORKS (PIPE TRENCHES)

PSDB 1 CLASSES OF EXCAVATION (Clause 3.1)

The excavation of material, for the purposes of measurement and payment shall be classified as specified in PSD 1.2.

SABS 1200 G: CONCRETE (STRUCTURAL)

PSG 1 MATERIALS

PSG 1.1 Applicable Specifications (3.2.1)

Add the following:

All cement types shall comply with the requirements of SABS ENV 197-1

For this contract only OPC CEM I, Class 42.5, cement shall be used.

PSG 1.2 CEMENT (3.2.1 and 3.2.2)

The grade of concrete shall be as specified on the drawings or schedule of quantities. Cement shall not be kept in storage for longer than four weeks and shall be used in the order in which it has been stored.

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PSG 3 CONSTRUCTION

PSG 3.1 Fixing (5.1.2)

The welding and the use of heat in cutting high tensile deformed bars (Y bars) shall not be permitted without the approval of the Engineer.

PSG 3.2 Cover (5.1.3)

The reinforcement shall be fixed with the minimum cover as specified on the drawings.

In the case of walls, columns, roof slabs, the minimum specified cover should be attained by one of the following methods, or as approved by the Engineer.

- (1) by using "cover block" manufactured from dense, strong cement/sand formed in a block with wire ties, cured under water for a minimum period of 7 days.
- (2) by the use of plastic spacers, set in an orientation so that no pockets of air can be trapped beneath them during vibration of the concrete.

PSG 4 FORMWORK

PSG 4.1 Design Of Forms

- (i) Forms shall conform accurately to the shape, lines, levels and dimensions of the concrete as shown on the drawings.
- (ii) The design of formwork and supports shall be the responsibility of the Contractor.
- (iii) Forms shall be designed as to support their mass, the load exerted by wet concrete and the vibration, construction or other loads that they may be subjected.
- (iv) All timber shall be free from holes, loose knots, cracks, splits, warps or other defects likely to affect the strength or appearance of the finished structures.
- (v) Wedges and clamps shall be used in preference to nails for securing the form components and wire ties or tie bolts in reinforced concrete, and must be capable of removal after use, except as otherwise specified.

PSG 4.2 Classification of Finishes (5.2.1)

Notwithstanding Sub-clause 5.2.1, finishes shall be classified as rough or smooth, as follows:

(a) Rough

Concealed surfaces and surfaces more than 200mm below final ground level

(b) Smooth

All surfaces not classified as "rough" in paragraph (a) shall be classified as "smooth". All exposed areas, unless other indicated, shall be chamfered 20mm x 20mm by means of a fillet fixed to the formwork.

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PSG 4.3 Removal of Formwork (5.2.5)

Add the following:

Removal of forms shall be determined by means of cubes cast with the concrete and cured in accordance with S.A.B.S. 863. The removal shall be carried out under the personal supervision of the Foreman, only after the permission of the Engineer has been obtained and in such a manner that the concrete is not jarred, vibrated or otherwise damaged. Where test cubes to determine stripping times are not made, the minimum periods which shall elapse between the time of the placing of the concrete and the time of removal of the forms, shall otherwise agreed with the Engineer, be in accordance with the table hereunder, where each day covers a full 24 hour period.

Delete Table 2 and replace with the following:

Minimum stripping Times in Days

	CEM I	CEM I	CEM II	CEM II	CEM III	CEM III
Type of structural Member of Formwork	Normal Weather (Above 15° C)*	Cold weather (Below 5°C)*	Normal Weather (Above 15° C)*	Cold weather (Below 5°C)*	Normal Weather (Above 15° C)*	Cold weather (Below 5°C)*
Beam sides, wall or unloaded cols	1	2	2	4	2	6
Slabs, with props left underneath	4	7	5	8	6	10
Beam soffits. Props left underneath	7	12	8	14	10	17
Removal of Slab Props	10	17	10	17	12	21
Removal of beam Props	14	21	14	21	18	28

*Average daily temperature of the atmosphere adjacent to the concrete as measured by a maximum and minimum thermometer.

PSG 5 CONCRETE

PSG 5.1 General (5.5.1.1)

Concrete shall comply with the requirements for strength concrete. (See clause 5.5.1.7)

Curing of concrete

Curing of concrete by means of surface water retention or use of an acceptable curing compound must be included to improve the impermeability of the concrete surface to chemical ingress.

Permeability and resistance to chemical attack can be enhanced by using the various proprietary materials available for the purpose which can be used as a coating, either barrier or penetrating. Information must be obtained from the manufacturer/supplier and included in your submission.

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PSG 5.2 Sample and Trial Concrete mixes

The concrete mixes for the grade of strength shall be designed by an approved design laboratory. The Contractor at his own cost shall supply to the laboratory samples of the cement and aggregate he proposes to use for the works. The proposed slumps and proportions of the materials to be used for each grade of concrete shall be submitted to the Engineer for his approval.

No structural concrete shall be placed on the job until the Contractor has satisfied the Engineer as to the suitability of the mixes concerned.

Trial panels for durability concrete (W class concrete)

As part of the durability class concrete mix design approval process, trial panels shall be constructed on the site (or at the laboratory) before construction of structural elements commences, to ensure that the contractor can successfully achieve the oxygen permeability and sorptivity targets set for the in-situ concrete with method of construction to be adopted. Each trial panel shall be constructed using the same type of concrete mix, shuttering type, placing and curing methods (including application rates of curing compounds if applicable) as to be used on the final structural element to be constructed. The dimensions of such a trial panel shall be 0.40m wide, 0.60m high and 150mm thick. The panel shall be constructed vertically. It is suggested that 2 lifting hooks be cast into the panel to facilitate lifting, moving or disposal of panel. It most likely will be that one trial panel will be required for substructures (piers, columns, retaining walls, etc) if the same grade concrete is specified for all substructures.

The test area for taking of cores (taken in horizontal direction) shall not be less than 100mm from all horizontal and vertical edges. The number of cores to be extracted and tested is described below.

Test panels for durability concrete (W class concrete)

During casting of concrete on site, test panels shall be constructed on the site adjacent to where the concrete element is being placed. Each test panel shall be constructed with the same concrete, shutter type, compaction and curing methods being used in the element being cast (including same vibrator frequency and curing compound application rates), and be left to cure for 28 days adjacent to the concrete element. Thereafter it shall either be cored on site or transported to the laboratory for testing of the required durability parameters. The dimensions of the test panels shall be 0,4m wide, 0,6m high and 150mm thick and be cast vertically to simulate vertical casts of the substructures and vertical faces of all structures. It is suggested that 2 lifting hooks be installed at both top ends of the test panel to assist with transport. For precast concrete, test panels will not be constructed, as cores will be drilled from the concrete elements at the Precast yard before being placed at its final location. For the horizontal faces of Columns/Surface Bed Slabs, Water Retaining Walls and All bases/foundations, test panels will also not be constructed. Instead cores will be extracted from the top surface of the test panels.

The frequency of the testing and number of cores to be extracted is described under below.

The test area for the taking of cores (taken in a horizontal direction) shall not be less than 100mm all horizontal and vertical edges.

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Testing for concrete durability

Durability predictions for durability concrete prefixed 'W' will be based on the following tests that shall be carried out by an accredited laboratory approved by the Engineer:

- (i) Oxygen permeability
- (ii) Water sorptivity
- (iii) Chloride conductivity

Notes:

The test methods shall be as described below.

For test no's (i) and (ii) (and (iii) when required), cores of 70 ± 2 mm diameter shall be extracted from the test panels when the concrete reaches the age of at least 28 days and tested.

Test No. (iii) may only be required where specified (e.g. within a chloride environment along the coast or where chlorides are present in ground water).

A sample for the purposes of durability testing is as defined in Table B8106/1. The cores for durability testing shall be extracted from the test panels for process and acceptance control (at the frequency as shown in Table B8106/2). Durability testing shall only be required for concrete specified as durability concrete with the prefix "W". The number of samples to be taken shall be as shown in Table B8106/2.

Table B8106/1: NUMBER OF CORE RESULTS REQUIRED FOR A SINGLE SAMPLE FOR DURABILITY TESTING

Durability Parameter	No. of Core Results
a. Sorptivity	1
b. Oxygen Permeability	2
c. Chloride conductivity	1

* Test undertaken only if specified and within a chloride environment.

Table B8106/2: Number of test panels required for durability testing

Element	No. of Test Panels to be taken (see Table B8106/1 for number of core results required for a single sample)
Water Retaining walls	1 (per element/pour) ²
All bases/foundations	1 (per element/pour) ²
Columns/Surface Bed Slabs	1 (per element/pour) ²

Note:

- Test panels required to be cast vertically. Additional cores required to be extracted from roof slabs/beams, i.e. in-situ cores.
- Note that where group of elements are cast on the same day, only one test panel will be required, but only if the same grade concrete is used.

For cores to be extracted from precast elements, the engineer will indicate the positions at which the cores will be extracted. Filling of the holes left by the drilling of the cores shall be the responsibility of the contractor and shall be carried out using an approved proprietary non-shrink repair mortar so as to restore structural integrity

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and durability of the structural element tested.

The methodology and latest revisions for the durability index tests are available at the University of Cape Town's web address at www.civil.uct.ac.za. In addition, the results of all the durability testing shall be submitted at least once a month in the required format to the University of Cape Town, where the present contact person is: Dr. H Beushausen - email: hans.beushausen@uct.ac.za.

Testing for concrete cover

Concrete cover testing shall be conducted using an approved calibrated electromagnetic cover meter, able to comply to requirements as defined in linear and block scans and has the ability to save and calculate data measured.

The testing (non-destructive) shall be conducted to confirm that the specified depth of concrete cover has been achieved. The cover meter tests shall cover at least 1m² for every 20m² surface area of concrete placed. Readings shall be taken to identify individual bars, with at least 3 readings at 100mm spacing on every single bar within 1m². The cover meter must be calibrated whenever being used to test for cover on each project. Standard Calibration block must be used on each project, and where substantial testing is required, the calibration block shall be kept on site. Cover meters shall comply with the relevant modern standards (e.g. EN55011, 50082-1, 6100-6-1, 6100-6-2, 6100-6-3, 6100-6-4 and BS18881 Part 204).

Critical elements for cover surveys are Columns/Surface Bed Slabs, Water Retaining Walls and All bases/foundations. The engineer will identify other critical areas required to be surveyed. Should any of these areas shows deficiencies, the engineer may order additional cover tests on other areas at the contractor's costs.

The procedure for testing for depth of reinforcement from concrete surface shall be in accordance with the manufacturer's requirements for the relevant electromagnetic cover meter. All cover meters shall be calibrated on site under the control of the engineer. The number of readings taken of the layer of rebar closest to the concrete surface to each 1m² to be tested shall be such that an accurate average cover can be determined for the tested area. For the purposes of calculating the average depth of cover bars that have covers 15mm or greater than what is specified shall be capped at specified cover plus 15mm in the calculations.

Example, where Specified cover = 40mm, test as 35mm, then apply limits, $85\% \times 35 = 30\text{mm}$.

Quick Scan readings are to be taken perpendicular to the layer of rebar closest to the concrete surface for each scan area (+/- 30 per m²), so that an average cover to reinforcement can be determined for the tested area.

Readings are to be taken to identify individual bars within each 1m². At least three cover readings, at 150mm spacing, per an individual bar shall be shown in the test results but only overall cover measurement would be used for payment purposes. Reports generated by the equipment shall be used for determining payment. Where more than 10% of readings are below specified lower limit, the area shall be re-scanned, by Image, Block or Grid scan method, to verify the average cover.

Cognizance to be taken of the effect to cover depth measured, where spliced bars are measured in same area as single bars. The size of rebar shall be corrected manually on the device by means of applying the following formula (approximately $1.41 \times \text{diameter of rebar as shown in design}$).

Where insufficient cover are established before placing of concrete, e.g. Starter bars from base not correct position, remedial action to be performed before continuing with next concreting – these actions to be clearly recorded and area identified.

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Cement Testing

All cement and cementitious materials incorporated into the Works shall comply with the applicable SANS standards and shall be sourced from approved manufacturers. The Contractor shall submit manufacturer's certificates of compliance and test certificates for each batch of cement delivered to the Site.

The Contractor shall ensure that cement testing is carried out by the manufacturer or by a laboratory approved by the Employer's Agent. Testing shall include, where applicable:

- Fineness of grinding;
- Initial and final setting times;
- Soundness;
- Compressive strength of mortar cubes at 2, 7 and 28 days;
- Quantitative determination of constituents;
- Equivalent sodium oxide content (Na_2Oeq);
- Sulphate content; and
- Any additional tests required by the Employer's Agent to verify compliance with the Contract Specifications.

Copies of all test certificates and laboratory reports shall be submitted to the Employer's Agent before the cement or cementitious materials are incorporated into the Works.

Each set of test results shall be representative of the cement supplied to the Site and shall be traceable to the relevant production batch. Unless otherwise approved by the Employer's Agent, testing shall be undertaken at a minimum frequency of one complete set of tests for every 200 tonnes of cement or cementitious material supplied to the Works, or for each production batch, whichever is more stringent.

Cement and cementitious materials stored on Site for more than 120 days from the date of manufacture shall not be used unless retested by an approved independent laboratory and certified as compliant with the applicable specification requirements. Thereafter, such materials shall be retested at monthly intervals or at such frequency as may be directed by the Employer's Agent.

The Employer's Agent reserves the right to obtain independent samples and arrange additional testing at any stage of the Contract. Where test results indicate non-compliance with the Contract Specifications, all associated testing costs, investigations, removal and replacement of affected works shall be for the Contractor's account.

AGGREGATES

PSG 13.3.3.1 General

All aggregates used in the Works shall comply with the requirements of SANS 1083 and the requirements of this Specification. Aggregates shall be obtained from approved quarry sources and shall be free from clay lumps, organic matter, shale, mica, weathered rock, deleterious substances, and any other materials that may adversely affect the strength, durability, watertightness or long-term performance of the concrete.

Prior to commencing production, the Contractor shall undertake a comprehensive sampling, testing and assessment programme of all proposed aggregate sources. The programme shall confirm the suitability of the aggregates for structural concrete, mass concrete, spillway concrete, outlet structures, training walls, stilling basins and all other hydraulic structures forming part of the Works. The testing programme shall be submitted to the Employer's Agent for review and acceptance before production commences.

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Aggregates shall be produced by approved crushing, screening, washing and processing operations. The Contractor shall provide and operate all equipment necessary to produce aggregates consistently complying with the specified grading requirements. Where necessary, secondary and tertiary crushing, washing, re-screening and blending shall be undertaken to achieve the specified grading and quality requirements.

The Contractor shall make allowance for deterioration, degradation and weathering of stockpiled aggregates. Aggregates that become contaminated, segregated, excessively weathered or otherwise unsuitable shall be removed from the Works and replaced at the Contractor's expense.

The Employer's Agent may require additional testing at any stage of the Contract to verify compliance with the Specification. No aggregate source shall be used without prior approval of the Employer's Agent.

PSG 13.3.3.2 Aggregate Gradings

Aggregates shall be processed and blended to produce concrete that satisfies the specified requirements for strength, durability, workability, impermeability and resistance to cracking.

The Contractor shall submit proposed aggregate grading curves and mix proportions for approval during the trial mix stage. Aggregate grading shall be maintained within approved tolerances throughout the Contract.

(a) Coarse Aggregate

Coarse aggregate shall comply with SANS 1083 and shall consist of hard, durable crushed rock obtained from approved quarry sources. The aggregate shall be well graded and shall not contain excessive flaky, elongated, soft or weathered particles.

The nominal maximum aggregate size shall be selected to suit the element being constructed and shall not exceed the limitations imposed by reinforcement spacing, concrete placement methods and structural requirements.

Compliance shall be demonstrated by sieve analysis carried out in accordance with the applicable SANS test methods.

(b) Fine Aggregate

Fine aggregate shall comply with SANS 1083 and shall consist of approved natural sand, manufactured sand, or a combination thereof. Manufactured sand shall be produced from sound, durable rock by approved crushing processes specifically designed to produce acceptable particle shape and grading.

Crusher dust and primary crusher tailings shall not be used unless specifically approved following detailed testing and trial mixes demonstrating compliance with all specification requirements.

The grading of fine aggregate shall be controlled to ensure uniformity of concrete production. Where necessary, two or more sand fractions shall be blended to achieve the approved grading envelope.

The fineness modulus of fine aggregate shall generally be maintained between 2.0 and 2.8 and shall not vary by more than 0.2 from the approved design value unless otherwise approved by the Employer's Agent.

PSG 13.3.3.3 Aggregate Quality Requirements

All aggregates shall comply with the following minimum requirements:

- Aggregate Crushing Value (ACV): Maximum 25%.
- Ten Percent Fines Value (TFV): Minimum 150 kN.
- Water Absorption: Maximum 2%.
- Soundness Loss: Maximum 12%.
- Clay Lumps and Friable Particles: Maximum 1%.
- Material Passing 0.075 mm Sieve: Maximum 2% for coarse aggregate and as approved for fine aggregate.
- Organic Impurities: Nil.

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Aggregates shall be tested at frequencies approved by the Employer's Agent and whenever changes in source material, processing methods or aggregate quality occur.

PSG 13.3.3.4 Flakiness Index

The flakiness index of coarse aggregate, when tested in accordance with the applicable SANS test method, shall not exceed 35%.

For concrete used in spillways, outlet structures, stilling basins, energy dissipation structures, training walls and other hydraulic structures subjected to abrasion or high-velocity flow conditions, the flakiness index shall not exceed 25%.

PSG 13.3.3.5 Alkali-Aggregate Reactivity

All aggregate sources shall be tested for Alkali-Silica Reactivity (ASR) and Alkali-Carbonate Reactivity (ACR) in accordance with recognised international standards.

Aggregates exhibiting potentially deleterious reactivity shall not be used unless approved mitigation measures, including the use of supplementary cementitious materials, are incorporated into the concrete mix design and accepted by the Employer's Agent.

PSG 13.3.3.6 Testing and Quality Control

The Contractor shall establish and maintain an approved quality control system for aggregate production and stockpile management.

Routine testing shall include, but not be limited to:

- Particle size distribution;
- Flakiness index;
- Water absorption;
- Relative density;
- Aggregate crushing value;
- Soundness;
- Deleterious materials;
- Moisture content; and
- Alkali-reactivity assessments where required.

All test results shall be submitted to the Employer's Agent and shall demonstrate continuous compliance with the approved mix design and specification requirements before incorporation into the Works

Soundness

Aggregates shall possess adequate resistance to weathering, wetting and drying cycles, and deterioration during handling, stockpiling and service conditions.

When tested in accordance with ASTM C88 and the applicable SANS test methods, coarse aggregate shall not exhibit a loss in mass exceeding 18%, and fine aggregate shall not exhibit a loss in mass exceeding 15%, after five cycles of testing using magnesium sulphate solution.

Where aggregate sources exhibit variable geological characteristics, the Employer's Agent may require additional soundness testing at increased frequencies. Aggregates failing to comply with the specified requirements shall not be incorporated into the Works.

Shrinkage

The shrinkage characteristics of aggregates shall be determined in accordance with SANS 5836 or an approved equivalent test method.

The drying shrinkage of concrete prepared using the proposed aggregates shall not exceed 150% of the shrinkage obtained using the approved reference aggregate designated by the Employer's Agent.

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The maximum permissible shrinkage limits shall be as follows:

- Fine Aggregate: Maximum 150% of the shrinkage of the approved reference aggregate.
- Coarse Aggregate: Maximum 150% of the shrinkage of the approved reference aggregate.

The Contractor shall report the quantity of water required to mould each test specimen together with the shrinkage test results. The Employer's Agent may reject aggregate sources exhibiting excessive shrinkage characteristics that may increase the risk of cracking in mass concrete, hydraulic structures or water-retaining structures.

Water Absorption

Aggregates shall have low water absorption characteristics to ensure durability and consistency of concrete quality.

When tested in accordance with SANS 3001-AG20, the total water absorption of the combined aggregate shall not exceed 2.0% by mass.

No individual nominal aggregate size fraction shall exhibit a water absorption greater than 3.0% by mass.

The Contractor shall determine and record the rate of absorption and the time required for the aggregates to reach a saturated surface dry (SSD) condition. These results shall be used in establishing pre-wetting requirements and in adjusting the concrete mix water to achieve the specified water-cement ratio.

Aggregates exceeding the specified limits shall not be used unless specifically approved by the Employer's Agent following detailed investigation and supporting test results.

Chloride Content

The chloride content of aggregates shall be determined in accordance with SANS 5830 or an approved equivalent standard.

The chloride content shall not exceed 0.03% by mass expressed as chloride ion (Cl^-).

In addition, the total chloride content of the completed concrete, including contributions from aggregates, cement, admixtures, water and any other constituents, shall comply with the requirements specified elsewhere in the Contract Documents.

Aggregates exceeding the specified chloride limits shall be rejected and removed from the Site at the Contractor's expense.

Sulphate Content

The sulphate content of aggregates shall be determined in accordance with SANS 5850 or an approved equivalent standard.

The sulphate content, expressed as sulphur trioxide (SO_3), shall not exceed 0.40% by mass.

The Contractor shall ensure that the total sulphate content of the concrete, including contributions from aggregates, cementitious materials, mixing water and admixtures, remains within the permissible limits specified for the Works.

Aggregates containing excessive sulphate levels or other deleterious chemical constituents that may adversely affect the durability of concrete shall not be incorporated into the Works.

Where sulphate-bearing groundwater, alluvial deposits, or weathered rock formations are encountered, the Employer's Agent may instruct additional chemical testing to verify the suitability of the aggregate source.

Total Chloride and Sulphate Content

The total chloride content arising from all constituents of the concrete mix, including aggregates, cement, supplementary cementitious materials, water and admixtures, shall not exceed the following limits, expressed as chloride ion and as a percentage of the mass of cementitious material in the mix:

(a) Prestressed concrete, steam-cured concrete, sulphate-resisting cement concrete, or supersulphated cement concrete: **0.05% maximum**.

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(b) Reinforced concrete and all other structural concrete: **0.10% maximum in 95% of all test results**, provided that no individual test result exceeds **0.25%**.

The total sulphate content, expressed as SO_3 , contributed by all constituents of the concrete mix shall not exceed **4.0% of the total cementitious content**.

Alkali Reactive Minerals

All proposed aggregate sources shall be evaluated for the presence of alkali-reactive minerals that may give rise to Alkali-Silica Reaction (ASR), Alkali-Silicate Reaction or other deleterious alkali-aggregate reactions.

Petrographic examination shall be carried out in accordance with ASTM C295 and ASTM C294, or approved equivalent standards, on representative samples covering all aggregate sources and lithological variations proposed for use in the Works.

Potential alkali reactivity shall be assessed in accordance with SANS 6245 or other approved test methods. The Contractor shall submit all test results and assessments to the Employer's Agent for review and acceptance.

The Contractor is advised that geological investigations have identified the presence of low to moderately strained quartz within the proposed aggregate sources. Such material may be susceptible to alkali-aggregate reaction under certain conditions.

To mitigate the risk of alkali-aggregate reaction, all concrete mixes shall incorporate a minimum of 30% Class F fly ash or other approved supplementary cementitious material unless alternative mitigation measures are proposed by the Contractor and approved by the Employer's Agent.

No aggregate source exhibiting unacceptable alkali reactivity shall be used without the implementation of approved mitigation measures and supporting laboratory evidence demonstrating long-term durability.

Organic Impurities

Fine aggregate shall be tested in accordance with SANS 5832 and shall comply with the limits specified in SANS 1083.

Aggregates containing organic impurities in excess of the specified limits shall not be used in the Works.

Clay and Silt Content

The clay and silt content of fine aggregate, determined in accordance with SANS 6244, shall not exceed 2.0% by mass.

Aggregates shall be washed where necessary to achieve compliance with the specified requirements.

Sand Equivalent

Aggregates shall be maintained in a clean condition throughout production, transport, stockpiling and use.

The sand equivalent of fine aggregate, when tested in accordance with ASTM D2419 or SANS 5838, shall not be less than 80.

The sand equivalent of the 0 mm to 4.75 mm fraction of all aggregate blends shall not be less than 75.

Aggregates failing to comply with the specified requirements shall be further processed, washed or rejected, as directed by the Employer's Agent.

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SABS 1200 GB: CONCRETE (ORDINARY BUILDINGS)

PSGB 1 SCOPE (Clause 1.1)

This section includes specifications for various aspects of concrete referred to in other sections of the standard specifications as well as the construction of cement screeds and waterproofing of concrete roof slabs.

PSGB 2 GENERAL

PSGB 2.1 WATERPROOFING

Waterproofing materials shall be transported, handled and stored with care and laid strictly in accordance with the manufacturer's instruction. A clean, dry, smooth, firm and structurally adequate base with a fall of at least 1 in 50 (depending on the material selected) is required with drainage to gutters and/or rainwater outlets on roof edges, as relevant. Attention shall be given to the detailed design of openings, projections, gutters, down pipes and finishes to make adequate provision for run-off water and to minimise blockages.

Corners and edges shall be covered or angle-rounded. Run-off over the edges of slabs shall be eliminated as this causes stains to the building. Fillets of 75 x 75 mm shall be provided at upstand corners.

The necessary gradient for waterproof membranes are normally provided on top of structures in low-density screeds and then finished, if necessary, with a cement/mortar topping.

PSGB 2.2 CEMENT SCREEDS

CEMENT

The grade of concrete shall be as specified on the drawings or schedule of quantities. Cement shall not be kept in storage for longer than four weeks and shall be used in the order in which it has been stored.

Mechanised plant e.g. scabblers or abrasive blasters must be used for complete removal of all laitance from the existing surface of the floor slab. Dust pollution should be kept to a minimum during these operations. Once the coarse aggregate of the slab is exposed, all dust and debris should be removed, surface thoroughly wetted and maintained for approximately 12 hours. A bond coat (1:1 mix of cement and fine sand) should be spread evenly over the surface using a stiff fibre brush. The screed must be laid and compacted in 1 layer. Screeds and toppings shall be of sufficient quality to provide a firm base. The following screed characteristics are suggested for waterproofing purposes:

- (a) Compressive strength of at least 25Mpa at 28 days;
- (b) Steel-trowel finish (light);
- (c) Drying shrinkage of less than 0.2% when tested in accordance with the testing conditions specified in SABS 836;
- (d) Minimum screed thickness of 40mm;
- (e) Maximum moisture content of screeds:
 - (i) Applications with a density of less than 500 kg/m³ : 10%
 - (ii) Applications with a density exceeding 500 kg/ m³ : 7%

The screed should be cast or sawn into panels that do not exceed 9m² to cater for drying shrinkage and to control cracking.

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PSGB 3 MEASUREMENT AND PAYMENT

PSGB 3.1 Cement Screeds for:

(a)	25mm screed on floors	unit: m2
(b)	25mm screed on roof slabs	unit: m2

The unit of measurement shall be the square metre of exposed surfaces to be screed.

The tendered rate shall include all costs for supplying, delivering, storing on site, handling, etc of the materials necessary for the screed, including mixing and laying of screeds currents and falls and forming of sundry items such as fillets, etc complete. The tendered rate shall also cover the cost for forming of screeds around outlets, waste and of all scaffolding, temporary supports, hoisting facilities, etc.

PSGB 3.2 Waterproofing of roof slabs with Derbigum or similar approved unit: m2

The unit of measurement shall be the square metre of the horizontal and vertical surfaces of waterproofing to the approval of the Engineers. All turn-ups and turn-downs will be deemed to be included in the area measured for the waterproofing and will not be paid for separately.

The tendered rate shall include all costs for supplying, delivering, storing on site, handling, moving, installing and fixing the waterproofing system complete with all necessary sundry items, such as flashing strips, dressing waterproofing around pipes and into outlets and channels. The tendered rate shall also cover the cost of cutting and waste and for scaffolding, hoisting facilities, etc.

SANS 1200 GA: CONCRETE (SMALL WORKS)

PSGA 1 SCOPE (Clause 1.1)

This section includes specifications for various aspects of concrete referred to in other sections of the standard specifications.

PSGA 2 CEMENT (3.2.1 and 3.2.2)

The grade of concrete shall be as specified on the drawings or schedule of quantities. Cement shall not be kept in storage for longer than four weeks and shall be used in the order in which it has been stored.

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SANS 1200 LB: BEDDING (PIPES)

PSLB 1 SCOPE (Clause 1.1)

This section includes bedding for water pipelines.

PSLB 2 BEDDING MATERIALS (Clause 3.4.1)

PSLB 2.1 Source of material

All bedding material obtained from commercial sources shall be subject to the approval of the Employer's Agent and shall comply with the requirements of SANS 1200 LB and the relevant pipe manufacturer's recommendations.

PSLB 2.2 Selective excavation for bedding materials

Notwithstanding the requirements of Clause 3.7 of SANS 1200 DB and Clause 3.4.1 of SANS 1200 LB, the Contractor shall employ selective excavation methods to preserve suitable excavated material intended for bedding, selected fill or pipe surround. Suitable material shall be kept separate from unsuitable material and protected against contamination, degradation and excessive moisture content.

PSLB 3 CRUSHED STONE BEDDING (New clause)

Where the trench bottom is unstable, waterlogged, soft, saturated or otherwise unsuitable for supporting the pipe bedding, the Employer's Agent may instruct the use of crushed stone bedding.

Crushed stone bedding shall consist of clean, hard, durable single-sized stone nominally 13.2 mm or 19 mm in size obtained from an approved commercial source.

The crushed stone shall be free of clay, silt, organic matter and other deleterious substances.

The thickness of the crushed stone layer shall be as directed by the Employer's Agent but shall not be less than 100 mm beneath the pipe barrel unless otherwise shown on the Drawings.

Where groundwater conditions exist, the Contractor shall take all necessary measures to prevent contamination of the crushed stone bedding during placement.

Payment for crushed stone bedding shall be made only where specifically instructed by the Employer's Agent.

PSLB 4 FREEHAUL (Clause 8.1.6)

All suitable bedding, selected fill and pipe surround material obtained from excavations within the Site boundaries shall be deemed to be freehaul. No separate payment shall be made for haulage, rehandling, stockpiling or transport of such material within the Site.

PSLB 5 COMPACTION OF BEDDING AND SELECTED FILL

Bedding, selected fill and pipe surround material shall be placed and compacted in layers to the requirements specified in SANS 1200 LB and the pipe manufacturer's recommendations.

Compaction testing shall be carried out at frequencies specified in the Contract Specifications and shall form part of the Contractor's Quality Control Programme.

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PSLB 6 TESTING

The Contractor shall undertake all sampling and testing necessary to demonstrate compliance of bedding materials with the Specification.

Testing shall include grading, density, moisture content and any additional tests required by the Employer's Agent.

All testing shall be carried out by a SANAS-accredited laboratory approved by the Employer's Agent.

PSL SANS 1200 L: MEDIUM PRESSURE PIPELINES

PSL MEDIUM PRESSURE PIPELINES (SANS 1200 L)

PSL 2 INTERPRETATION

PSL 2.4 ABBREVIATIONS

Add the following to this Sub-Clause:

AC or FC - (Fibre reinforced cement)

HDPE – High-density polyethylene

PVCo- Oriented Polyvinyl Chloride

PSL 3 MATERIAL

PSL 3.1 GENERAL

Add the following paragraph:

"Each type of pipe delivered to the Site shall have a standard length corresponding with the standard lengths offered by the pipe manufacturer in his catalogue, with a maximum permissible variation in length of $\pm 2\%$.

A pipe that is a shorter or longer than the defined standard will be rejected by the Engineer, except when such non-standard lengths are required in terms of the Contract and have been specifically manufactured or cut as such by the pipe manufacturer or supplier."

PSL 3.3 CI PIPES, FITTINGS AND SPECIALS

Add the following to this Sub-Clause:

All cast iron pipes and fittings shall comply with the requirements of BS 2035 and unless otherwise specified, pressure class K9 and shall be of class D quality for straight pipes and of class CD quality for fittings. Materials used shall comply with the requirements of SANS 1034 grade 300 for "Grey Iron Castings".

PSL 3.7 Other types of pipes (Sub-Clause 3.7)

PSL 3.7.1 oPVC Water Pipes

Water pipes that have to be supplied shall be Class 25 oPVC spigot and socket or similar approved pipes unless otherwise specified, complying with SANS 996-1-2010 and diameters as set out in the Schedule of Quantities.

PSL 3.7.2 Galvanised Pipes

Galvanised steel pipes shall be supplied for inside isolation valve and bulk water meter boxes (diameters as indicated), unless otherwise indicated on drawings. Materials to be in **accordance of SANS 62**.

PSL 3.7.3 PVC-O

PVC-O pipes as specified in specification drawings and BOQ shall be supplied. Pipe material to be in accordance with SANS 16422.

PSL 3.8.3 Flanges and Accessories

Add the following to this sub clause:

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The dimensions and drilling of standard flanges shall comply with the requirements of SANS 1123 table 16 for pipes and fittings with a diameter of 150 mm and smaller and in accordance with table 10 for diameters exceeding 150 mm unless stated otherwise. Flanges shall be machined flat, i.e. without a raised joint face. Puddle flanges shall have the same dimensions as standard flanges but shall be undrilled.

Faces of flanges which will be in contact with jointing gaskets shall receive a protective coating similar to the corrosion protection specified for the internal surface of the pipes and fittings of such thickness and consistency as will not impair the air/gas/water tightness of the joint.

The jointing gaskets shall comply with the requirements of BS 3063 and shall be cut to the full width of the flange and holed for bolts.

PSL 3.9 CORROSION PROTECTION

PS L 3.9.2.1 Steel pipes of nominal bore up to 150 mm

Add the following to L 3.9.2.1:

The requirements of PS L 3.9.2.2 shall apply mutatis mutandis.

PS L 3.9.2.2 Steel pipes of nominal bore over 150 mm

Add the following to L 3.9.2.2:

All mild steel pipes under this contract shall be treated in accordance with L 3.9.2.2(b)(2) on the inside and the outside, with a polyamide-cured epoxy system similar and equal to Copon EP 2300 or Amercoat 385. The Contractor shall furnish the Engineer with certificates of tests in accordance with L 7.4.

Substitute "250 µm" in L 3.9.2.2(b)(2) with "300 µm".

Surge

The Contractor shall ensure that all pipes, fittings, valves and appurtenances are suitable for the maximum operating pressure plus surge pressure.

Where required by the Engineer, surge calculations shall be submitted for approval prior to installation.

Handling and Storage

Pipes shall be handled using approved lifting equipment. Dragging of pipes along the ground shall not be permitted.

Pipes shall be stored on level ground and protected from damage and excessive exposure to sunlight.

River Crossings

River crossings shall be constructed in accordance with the Drawings.

Pipelines crossing watercourses shall be protected against erosion, scour and flotation.

Concrete encasement, anchor blocks, gabions, riprap or other protection measures shall be installed where specified.

Disturbed river banks shall be rehabilitated immediately after construction.

PSL 3.9.5 Joints, Bolts, Nuts and Washers

Add the following to this sub clause:

Bolts and nuts for standard flanges shall comply with the requirements of SANS 1123 for a working pressure as specified for the flanges in conjunction with which they are to be used.

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The jointing gaskets shall comply with the requirements of BS 3063 and shall be cut to the full width of the flange and holed bolts.

All other bolts and nuts shall comply with the requirements of SANS 136 and shall be of grade 4,6 steel. Washers shall be provided at each nut and shall be of the same material (or coating where applicable) to match the bolt and nut.

Bolts shall project not less than 3 mm and not more than 10 mm from the heads of the nuts after tightening.

Bolts to be installed above ground level directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be hot-dip galvanized in accordance with the requirements of SANS 763. All other bolts shall be hot-dip galvanized in accordance with the requirements of SANS 763 and afterwards painted with the pipework and fittings as specified in Clause 3.9.

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by metallic action.

PSL 3.10.1 Gate Valves

All gate valves shall be standard waterworks pattern comply with the requirements of SANS 664 and shall be suitable for a working pressure of 2.5 MPa (Class 25) and 1.6 (Class) as specified. All gate valves must be supplied with a square spindle nut, suitable to be used with a valve key. One valve key per nut size must be provided and will be included in the rate for valves.

Gate valves shall be clockwise closing. The direction for opening and closing shall be permanently displayed on the valves. Valves shall have non-rising spindles.

Compression shut-off valves with rubber protected gate and smooth finish without recess inside, may be used. The body and bonnet shall be epoxy coated internally and externally.

The spindle seal shall consist of at least two O-rings located in a corrosion resistant housing. A wiper ring to prevent ingress of dirt shall be provided. The spindle nut may be loose or fixed in the gate.

The valves shall be provided with a straight, unobstructed body passage without any pocket and the gate shall be completely clear of the waterway in the fully open position. The sealing and gate guide areas shall be designed to eliminate deposits in the valve body. The gate guide areas shall be designed to eliminate deposits in the valve body. The gate guides shall be of substantial design to support the gate until the point of closure.

All components shall be interchangeable between valves of one size. The rated working pressure shall be 16 or 25 bar as specified. The valve shall be capable of being opened and closed under an unbalanced pressure equal to the rated working pressure.

All flanged gate valves shall be drilled according to SANS 1123 Table 1600/3 or 2500/3.

Pipes shall not be tested against a closed valve. Thrust blocks for test sections shall be approved by the Engineer prior to testing of pipes.

PSL 3.10.2 Air Valve

Air valve for potable water shall have a pressure rating as specified on the drawings. All air valves shall be double action air valves of Vent-o-mat RBX, or similar approved.

The branch of the tee on the main pipe shall be minimum 0.67 (2/3) of the diameter of the main pipe.

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Double-acting air valves shall have large as well as small orifices. The large orifice shall have a rubber bed, and the small orifice a brass bed on which the balls can shut. Double-acting air valves shall be flanged and supplied with flanged isolating valves. Air valves shall be designed into remain open until all the air has escaped and shall not close due to the speed of the escaping air.

The valve shall incorporate an integral "Anti-Shock" orifice mechanism which, during the pipeline filling operation and when a separated water column proceeds to re-join, shall operate automatically to limit transient pressure, rise induced by large orifice closure to a maximum of 2 x valve rated working pressure

PSL 3.10.4 Reflux Valves (Non-Return)

Reflux valves shall have a class 16 pressure rating as specified and, unless otherwise indicated, shall be flanged, drilled to SANS 1123, Table 1600/3 or 2500/3. The casing and flap shall be manufactured from close-grained cast iron with a brass face on the flap that close onto a corresponding brass plane in the casing.

The hinge pin shall swivel freely in bearings on both sides of the casing. Cone-shaped rubber-seal reflux valves with stainless steel may be used if approved by the Engineer.

**PSL 3.10.5 Bulk Water Meter
Mechanical Flow Meters**

New Mechanical bulk water meters shall be installed as shown on drawings.

Functional Requirement of Bulk Water Meters

DESCRIPTION	METER
1. Detail of pipeline	Varies
2. End connections	Flanged, SANS 1123 (Class 1600/3)
3. Permanent flow rate	Varies m ³ /h
4. Size of meter	Varies

Technical Requirements for the Meters

The bulk water meters shall be combination cold water meters (type C3200 by ABB, Kent or similar as approved by Engineer) and flanged on both sides. A distance of 5 times the diameter of the pipe before and 3 times the diameter after the water meter must be kept free of any obstructions such as bends, reducers, etc. unless it is approved by the Supplier that above conditions is not required, to be approved by Engineer.

The flow reading shall be given on a dial face and totalizing shall occur by means of a roller counter and shall be accurate within $\pm 2\%$. The body shall be manufactured from spheroidal graphite iron.

The meter shall be manufactured in such a way that all moving parts can be removed and replaced from the top without removing the whole meter. Replacement parts should be freely available. Each water meter installation shall be supplied with a gate valve on the upstream side of the water meter. This gate valve shall be provided for under the relevant item in the schedule of quantities. The water meter shall have provision to log the records manually and electronically (Data Logging).

Installation of Meter

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The meter shall be installed by a person approved by the supplier in order to validate the guarantee.

All accessories for the complete installation shall be supplied by the Contractor.

All metal work shall be painted according to specifications after the testing and completion of the installation. Each meter must be supplied with a blind flange. The meter mechanism may only be installed after the pipeline has been completely constructed, flushed and tested.

Electromagnetic Flow Meters

New Electromagnetic bulk water meters shall be installed as shown on drawings.

Technical Requirements for the Meters

The bulk water meters shall be of the magnetic flow type cold water meters (approved by Engineer) and flanged on both sides. A distance of 5 times the diameter of the pipe before and 3 times the diameter after the water meter must be kept free of any obstructions such as bends, reducers, etc. unless it is approved by the Supplier that above conditions is not required, to be approved by Engineer.

The flow reading shall be given on a digital transmitter face indicating the instantaneous flow and totalized volume and shall be accurate within $\pm 2\%$.

The meter shall be manufactured in such a way that all moving parts can be removed and replaced from the top without removing the whole meter. Replacement parts should be freely available. Each water meter installation shall be supplied with a gate valve on the upstream side of the water meter. This gate valve shall be provided for under the relevant item in the schedule of quantities. The water meter shall have provision to log the records manually and electronically (Data Logging).

Installation of Meter

The meter shall be installed by a person approved by the supplier in order to validate the guarantee.

All accessories for the complete installation shall be supplied by the Contractor.

All metal work shall be painted according to specifications after the testing and completion of the installation.

The meter mechanism may only be installed after the pipeline has been completely constructed, flushed and tested.

PSL 3.10.6 Control Valves

Surge Anticipating Valves shall open to a high and low pre-set pressure regardless of fluctuating demand or varying upstream pressure.

Level control valves shall be hydraulically controlled by modulating vertical float, diaphragm actuated control valve controlling reservoir filling to maintain a constant water level regardless of fluctuating demand.

Main Valves: The main valve shall be a centre guided, diaphragm actuated globe valve of either oblique (Y) or angle pattern design. The body shall have a replaceable, raised, stainless steel seat ring. The valve shall have an unobstructed flow path, with no stem guides, bearings, or supporting ribs. The body and cover shall be ductile iron. All external bolts, nuts, and studs shall be Duplex® coated. All valve components shall be accessible and serviceable without removing the valve from the pipeline.

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Actuators: The actuator assembly shall be double chambered with an inherent separating partition between the lower surface of the diaphragm and the main valve. The entire actuator assembly (seal disk to top cover) shall be removable from the valve as an integral unit.

The stainless-steel valve shaft shall be centre guided by a bearing in the separating partition. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-Port Throttling Plug by bolting.

Control System (Surge Anticipation): The control system shall consist of two 2-Way adjustable, direct acting, pressure reducing pilot valves, needle valves, isolating cock valves and filters. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested and factory adjusted to customer requirements.

Control System (level control): The control system shall consist of a 4-way adjustable, last position bi-level vertical float and sensing line (extended rod to be balanced by counterweights installed on the lever system according to rod length and system pressure and to be installed in a stilling basin), needle valves, isolating cock valves, and strainers. All fittings shall be forged brass or stainless steel. The assembled valve shall be hydraulically tested and factory adjusted to customer requirements.

Quality Assurance: The valve manufacturer shall be certified according to the ISO 9001 Quality Assurance Standard. The main valve shall be certified as a complete drinking water valve according to NSF, WRAS, and other recognized standards.

PS L 3.11 Manholes and Surface Boxes

PS L 3.11.4 Step Irons

Substitute L 3.11.4 with the following:

Step irons shall consist of polypropylene coated 12 mm high tensile steel such as Calamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer.

PS L 4 Plant

PS L 4.3 Testing

Add the following to L 4.3:

The Contractor must ensure that the test equipment is in good working order and that it is calibrated.

PSL 5 CONSTRUCTION

PSL 5.1.4 Covering Required

The minimum covering measuring from the soffit of the pipe to the final prepared ground level shall not be less than 1000mm. Where applicable (Road Crossings etc.) the Engineer may order pipe encasing to protect shallow pipelines.

PSL 5.6 VALVE AND HYDRANT CHAMBERS

PSL 5.6.1 General

Replace the words "drawing L-1" in the second line with "the Drawings".

PSL 5.6.2 Construction of chambers

Replace the words "drawing L-1, L-2 and L-3" in the fourth line with "the Drawings".

PSL 5.11 MARKER BLOCKS

Marker blocks shall be manufactured and positioned as shown on the Drawings.

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PSL 5.12 PIPELINE ROUTE MARKERS

Route markers for the various water pipelines shall be erected in the positions and shall be manufactured according to the details shown on the Drawings.

PSL 7 TESTING

PSL 7.3.1.1 Test Pressure

All Class 25 (PN25) pipelines shall, for testing purposes, be assumed to have a working pressure of **2 500 kPa**.

The field test pressure shall be **1.25 times the working pressure**, resulting in a minimum hydrostatic test pressure of **3 125 kPa**, unless otherwise specified by the pipe manufacturer or shown on the Drawings.

The Contractor shall carry out hydrostatic pressure testing in accordance with the relevant SANS specifications and the pipe manufacturer's recommendations. The Contractor shall allow for testing the pipeline in suitably short sections such that the difference between the minimum and maximum pipe elevations within any test section does not result in pressures exceeding the allowable test pressure of the pipe, fittings, valves, thrust blocks or appurtenant structures.

The maximum permissible elevation difference within any test section shall be determined by the Contractor and submitted to the Employer's Agent for approval prior to testing. Particular consideration shall be given to the significant static pressure increases resulting from elevation differences along the pipeline alignment.

All testing equipment, temporary bulkheads, anchors, connections, water supply, pressure gauges, recording equipment and other requirements necessary to complete the pressure testing shall be provided by the Contractor.

PSL 7.3.1.2 Method of testing

- a. The Contractor shall provide an approved test pump, an accurate water meter, sealed pressure gauge, tested and certified by an independent testing organization, and all other equipment, materials and labour required for the test.
- b. The section of pipeline to be tested shall be clean and closed off at the ends by isolating valves, end caps or approved end-closure pieces. Free ends shall be firmly strutted against solid supports or thrust blocks designed to withstand safely 2 times the calculated and thrust under maximum test pressure. It shall be incumbent on the Contractor to establish the need for blank flanges or isolating valve flanges in order to limit leakage rates past gates, blades and seals.
- c. During this initial filling stage, the pipeline joints and all specials, fittings and valves shall be visually inspected for visible leaks and same rectified before proceeding with the test.
- d. The pressure shall be maintained for one hour and if a pressure drop occurs, more water shall be added to reinstate the test pressure and the valve closed again. The quantity of water added shall be measured by recording the readings before and after pumping.
- e. This procedure shall be repeated for a period of 24 hours, with water added at hourly intervals where necessary to reinstate pressure and water meter reading recorded. At the end of the 24-hour period, the aggregate quantity of water required to reinstate pressure over 24 hours shall be determined.
- f. The contractor shall give the Engineer 48 hours written notice of his intention to commence pressure testing and the Engineer may attend and supervise all or any part of tests. All records and recording charts shall be handed to the Engineer as soon as tests over any section have been completed.

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- g. All valves, specials, fittings and exposed joints, shall be inspected visually during the 24 hours pipeline test and all visible signs of leaks, sweating and distress shall be reported and attended to without delay.

PSL 7.1.3 Remedial Measures

- 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 to 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 retest parts or the whole of the pipeline at the Contractors 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 retests are the result from damages caused to the pipeline by the Employer.

PSL 7.1.4 Anchor / thrust blocks and pedestals

Dimensions at all anchor / thrust blocks shall be supplied by the Engineer as and when required. The Contractor shall request such information not less than seven (7) calendar days in advance.

PSL 7.1.5 CONNECTION TO METHULA AND MAYFLOWER WATER TREATMENT WORKS

The Contractor shall not, under any circumstances, connect the new bulk water pipelines, rising mains, valves, fittings, control systems or any associated infrastructure to the existing Mayflower Water Treatment Works or Methula Water Treatment Works without the prior written approval and instruction of the Employer's Agent.

No connection to the existing facilities shall be undertaken until the relevant sections of the Works have been completed, inspected, pressure tested, disinfected where applicable, commissioned and accepted by the Employer's Agent. The Contractor shall submit a detailed method statement for each connection at least fourteen (14) days prior to the proposed connection date. The method statement shall include the proposed sequence of work, shutdown requirements, temporary works, health and safety measures, contingency arrangements, commissioning procedures and the anticipated duration of any service interruptions.

The Contractor shall liaise and coordinate all connection activities with the Employer, the operating staff of the Mayflower and Methula Water Treatment Works, and any other affected stakeholders. Any shutdowns required for tie-ins to existing infrastructure shall be planned to minimise disruption to water treatment operations and shall only be undertaken at times approved by the Employer.

All costs associated with planning, coordination, temporary works, shutdowns, testing, commissioning, supervision, labour, plant, materials and reinstatement necessary for the successful completion of the connections shall be deemed to be included in the Contractor's tendered rates.

The Contractor shall remain responsible for the integrity and performance of the new works until the connections have been successfully completed, commissioned and formally accepted by the Employer's Agent. Any damage caused to existing infrastructure during the execution of the connection works shall be repaired immediately at the Contractor's expense.

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Following completion of the connections, the Contractor shall demonstrate, to the satisfaction of the Employer's Agent, that the pipelines, valves, flow measuring equipment, control systems and associated infrastructure are fully operational and performing in accordance with the Contract requirements before the Works are accepted.

PSL 8 MEASUREMENTS AND PAYMENT

PSL 8.2 SCHEDULED ITEMS

PSL 8.2.1 Anchor Blocks and Pedestals

Unit : m3

Substitute L 8.2.11 with the following:

The concrete shall be measured net volume to the specified width and depth in excess of the external volume of the pipe (i.e. the volume of the pipe will be deducted). The rate shall cover the cost of formwork and concrete.

Insert "concrete" before "and" in the last line of the last paragraph.

Add the following:

The tendered rates shall also include the wrapping of oPVC pipes and fittings with 3LPE Coating or a similar approved material where the pipes and fittings come into contact with concrete."

PS LB :BEDDING (PIPES)

PS LB 1 SCOPE

Add the following to LB 1.1:

This specification also covers the bedding required for electric cables.

PS LB 3 MATERIALS

PS LB 3.1 SELECTED GRANULAR MATERIAL

Substitute LB 3.1 with the following:

Selected granular material shall be an aggregate, sand or granular material, all of a non-cohesive nature and free from any organic material, of which the grading analysis shows 100 % passing a 13,2 mm sieve and not more than 5 % passing a 0,075 mm sieve. In very wet conditions and if so ordered by the Engineer, a non plastic crushed material with the specification as stated underneath should be used for bedding cradle.

a) Grading

Sieve size (mm)	% going through
19,0	100
13,2	84 - 100
9,5	70 - 84
4,75	45 - 65
2,36	29 - 47
1,18	19 - 33
0,600	13 - 25
0,300	10 - 18
0,150	6 - 13

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0,075	4	-	10

b) **Crusher value**

The aggregate crushing value, calculated at minus 13,2 mm plus 0,5 mm fraction, may not exceed 29.

PS LB 3.2 Selected Fill Material

Substitute LB 3.2 with the following:

The requirements of PS LB 3.1 shall apply mutatis mutandis.

PS LB 3.3 BEDDING

Add the following to LB 3.3:

All pipes shall be classified as rigid pipes and shall be laid on a Class C bedding except water connections, which shall be classified as flexible pipes. Cable bedding is specified separately.

PS LB 3.4.1 Suitable Material Available From Trench Excavations

Substitute LB 3.4.1 with the following:

The provisos of PS D 3.3.1 shall apply mutatis mutandis.

PS LB 3.5 Bedding in Waterlogged Conditions

In waterlogged conditions, the Engineer may instruct the Contractor in writing to use a bedding cradle comprising single sized 6,7 mm crushed stone complying with SANS 1083.

PS LB 5 Construction

PS LB 5.1 General

PS LB 5.1.4 Compacting

Substitute "90 %" in LB 5.1.4 with "93 % (100 % for sand)".

PS LB 5.5 Placing and Bedding of Cables

Bedding and backfilling for cables shall be executed under this contract. Cables shall be installed by the mechanical contractor. Machine compaction shall not be carried out directly over cables, unless the cables are covered by at least 300 mm of fill material.

PS LB 8 Measurements and Payment

PS LB 8.1 Principles

PS LB 8.1.5 Disposal of Displaced Material

Add the following to LB 8.1.5:

The requirements of PS D 5.2.2.3 shall apply mutatis mutandis.

PS LB 8.2 Scheduled Items

Add the following to LB 8.2:

PS LB 8.2.6 Supply and Place Bedding Material for Cables, from

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- a) Trench excavations Unit : m³
- b) Other excavations Unit : m³
- c) Borrow pits Unit : m³
- d) Commercial sources Unit : m³

Bedding and selected fill for cables shall not be measured separately.

No differentiation shall be made between trenches, bedding and backfilling for cables to be installed by the Contractor or the mechanical contractor.

The rate shall cover the cost of acquiring, regardless of the distance of bedding and selected fill material that complies with the requirement of PS LB 3.3, of delivering it to points alongside the trench spaced to suite the Contractor's methods of working, placing it in layers and compacting, as specified, and of disposing of displaced material. No additional payment will be made for co-operating with the mechanical contractor during the laying of cables and the cost related thereto shall be deemed to be included in the rate for supplying and placing the bedding material.

THE CONTRACT PART C3: SCOPE OF WORKS

Particular Specifications

Occupational Health and Safety Specification for Principal Contractors and Contractors for Construction Work

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1. Introduction

In terms of Construction Regulation 7 this document describes the health and safety specifications required for any principal contractor whom is making a bid for or whom has been appointed to perform construction work on behalf of the client. [Ref. CR 5(1)(a)]

- A principal contractor is required to compile their Health and Safety Plans based on these specifications detailed and referred to, in this document.
- In other words, the Health and Safety Plan must specify how the Principal Contractor will control and manage all health and safety aspects on the construction site.
- The Health and Safety Plan must be relevant to the construction work being carried out and if possible refer to the numbering system of this document.
- A principal contractor is to ensure that these specifications are communicated to all contractors under his/her agreement.

2. Reference Documents

The following documents are referred to:

2.1. Occupational Health and Safety Act, (Act No. 85 of 1993) - [OHSA] and Regulations.

2.2. Civil, Mechanical, Structural and Electrical Drawings [CME]

1..1 Drawing References:

1..1.1 Drawing No:____

1..1.2 Drawing No:____

1..1.3 Drawing No:____

1..1.4 Drawing No:____

1..1.5 Drawing No:____

2.3 Compensation for Occupational Injury and Diseases Act – [COIDA]

3. Scope of Work

Detailed Description of work to be carried out

- Earthworks
- Excavations
- Work @ Height
- Pressure Testing
- Vehicle & Mobile Plant
- Concrete Works
- Support and Formwork
- Structures
- Electrical Works

List of plant, machinery and tools to be used during the project:

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- Construction & Mobile Plants
- Hand Tools
- Portable Electrical Tools
- Ladders
- Further Information to be provided by contractor

List of Major hazards identified in the design risk assessments:

- Working at Heights
- Earth Works & Excavation
- Construction vehicles and Mobile plants
- Pouring Concrete
- Use of Power Tool
- Structures / False Work
- Shuttering
- Steel work

4. Definitions

The following definitions apply. (Abbreviations and legal references in brackets where applicable):

Construction Work

Means any work in connection with –

- a) The erection, maintenance, alteration, renovation, repair, demolition or dismantling of or an addition to a building or any similar structure;
- b) The installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling;
- c) The construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
- d) The moving of earth, clearing of land or making of an excavation or work on any similar type of work.

Hazard Identification, Risk Assessment and Risk Control (HIRA)

Means a documented plan, which identifies hazards, assesses the risks and detailing the control measures and safe working procedures, which are to be used to mitigate and control the occurrence of hazards and risks during construction or operation phases.

Site

Means the area in the possession of the Contractor for the construction of the works. Where there is no demarcated boundary it will include all adjacent areas, which are reasonably required for the activities for the Contractor, and approved for such use by the client.

Hazard

Means a source of or exposure to danger (source which may cause injury or damage to persons, or property)

Risk

Means the probability or likelihood that a hazard can result in injury or damage.

Construction Supervisor [CR 8(7)]

Means a full time, competent employee appointed in writing by the Contractor to supervise construction work. The appointment, as required by the OHSA, shall stipulate health and safety responsibilities, area of responsibility and the proposed duration of the project.

Construction Plant

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Encompasses all types of plant including but not limiting to, cranes, piling frames, boring machines, and excavators, dewatering equipment and road vehicles with or without lifting equipment

Contractor

Means an employer who performs construction work and includes principal contractors and sub- contractors.

Health and Safety Plan (HSP)

Means a documented plan, which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified.

The plan shall be applied from the date of commencement of and for the duration of construction work.

Health and Safety File (HSF)

The file holding all documentation and records on health and safety for the project, which shall be available at all, times for evaluation, and a copy of which will be forwarded to the client upon completion of the project.

Disabling Injury Frequency Rate (DIFR)

The number of disabling injuries (DI"s) multiplied by a constant (man hours relative to period worked) divided by total man hours worked over a rolling period (usually 12 months, but can be less)

Disabling Injury Severity Rate (DISR)

The number of days lost due to DI"s multiplied by a constant (man hours relative to period worked) divided by total man hours worked over a rolling period (usually 12 months, but can be less)

Confined Space

An enclosed, restricted or limited space in which, because of it's construction, location or contents, or any work carried on therein, a hazardous substance may accumulate or an oxygen deficient atmosphere may occur, and includes any chamber, tunnel, pipe, pit, sewer, container, valve, machinery or object in which a dangerous liquid or dangerous concentration of gas, vapour, dust or fumes may be present

5. Responsibilities of Contractors for Construction Work

5.1. Notification of Intention to Commence with Construction Work

The principal contractor shall notify the Provincial Director of the Department of Labour before any work commences, in accordance with the following requirements:

- The demolition of a structure exceeding a height of 3 meters; or
- The use of explosives to perform construction work; or
- The dismantling of fixed plant at a height greater than 3 meters; or
- The work exceeds 30 days or will involve more than 300 person days of construction work; and
- Includes excavation work deeper than 1 meter; or
- Includes working at a height greater than 3 meters above ground or a landing.

The notification must be completed in the **Annexure 2** form and a copy of the proof of fax or delivery to the Department of Labour to be kept in the Health and Safety File for inspection by an inspector, the client or an employee.

5.2. Principal Contractor's Responsibilities

Compile a Health and Safety Plan

Ensure co-operation between all contractors to comply to the Act

- Ensure compliance to the Act in terms of:

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- a) Provide relevant sections of these specifications to contractors as required
- b) Appoint each contractor in (a) above in writing. Only contractors who have the necessary competencies and resources may be appointed
- c) Ensure each contractor's Health and Safety Plan is implemented and maintained on site
- d) Stop any contractor from work which is not in accordance with Health and Safety Plan's or which pose a threat to health and safety of persons
- e) Sufficient information is provided to contractors where there are changes to design and construction
- f) Ensure every contractor is registered and in good standing with the Compensation Commissioner
- g) Ensure potential contractors have made provision for the cost of health and safety measures. Negotiate and approve the Health and Safety Plan of each contractor.

- All Health and Safety File's including the principal contractor's to be available on site.
- A consolidated Health and Safety File to be handed over to the client on completion of construction including records of drawings, designs etc.
- Health and Safety File to include updated list of all contractors, the agreements and their type of work.
-

5.3 Contractor's Responsibilities (including sub-contractors)

- Provide their Health and Safety Plan to the principal contractor.
- Where a contractor appoints another contractor (sub-contractor) it is the responsibility of that contractor to apply 4.2 above as if he were the principal contractor.
- No contractor to appoint another contractor (sub-contractor) unless the latter has the necessary competency and resources to perform the required work.
- To provide any information which affects the health and safety of any persons at work to the principal contractor.

5.4 Legal Appointments

The principal contractor shall ensure copies of the appointment letters of all responsible persons appointed on site will be kept in the Health and Safety File. All legal appointments shall be conducted in accordance with the requirements set out in the OHS Act and as per this specification. The tables below set out the appointment protocols for CR and OHS Act. It should be noted that these represent a complete list and not all these appointments may be required:

Construction Regulations

Reg.	Appointment	Appointee	Competency Required
CR 7 (1)	Principal Contractor	16(2) for the company	Curriculum Vita on file and Supervisor training (legal liability)
CR 5 (3b)	Contractor	Competent person	Proof of induction
CR 8 (1)	Contracts Manager	Competent Person	Certificate & CV
CR 8 (2)	Ass Construction Manager	Competent Person	Certificate & CV
CR 8 (7)	Construction Supervisor	Competent person	Curriculum Vita on file and Supervisor training (legal liability)
CR 8 (8)	Assistant Construction Supervisor	Competent person	Curriculum Vita on file and Supervisor training (legal liability)
CR 8 (5)	Safety Officer	Competent person	Curriculum Vita on file and SAMTRAC or similar
CR 9 (1)	Risk Assessor	Competent person	Curriculum Vita on file and HIRA or similar

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CR 10 (1)	Fall Protection Planner	Competent person	Curriculum Vita on file and Fall Plan Developer
CR 12 (1)	Temporal Works	Competent person	Curriculum Vitae
CR 13 (1)	Excavation Work Inspector	Competent person	Curriculum Vita on file and Supervisor training (legal liability)
CR 23 (1j)	Construction Vehicle Inspector	Competent person	
CR 23 (1d)	Construction Vehicle Operator	Competent person	Certificate of Competency for relevant construction vehicle
CR 28 (a)	Stacking and Storage Supervisor	Competent person	
CR 29 (h)	Fire Equipment Inspector	Competent person	
CR 29 (i)	Fire Team Members	Competent person	Fire Fighting Certificate

OHS Act

Reg.	Appointment	Appointee	Competency Required
OHSA 17 (1)	Health & Safety Rep	Nominated employee	Health and Safety Representative Certificate
OHSA 19 (1)	Health & Safety Committee Member	Management representative	Curriculum Vita on file and Supervisor training (legal liability) and IRCON or similar
GAR 9 (2)	Incident Investigator	Competent person	Curriculum Vita on file and RCAT or similar
GSR 3 (4)	First Aider	Competent person	First Aid Certificate
GSR 13	Ladder Inspector	Competent person	In house Training
DMR 18 (11)	Lifting Equipment Operator	Competent person	Code 1, 2, 3, 32, 33, 35 or 46
DMR 18 (5)	Lifting Equipment Inspector	Competent person	
	Hand Tools Inspector	Competent person	In house Training
	Pneumatic Tools Inspector	Competent person	In house Training
EMR 9(4)	Portable Electrical Equipment Inspector	Competent person	

The responsibilities of each appointment are detailed in the relevant form, which are signed by both the authorised person and the appointee and kept in the Health and Safety file. An example of an appointment form for a Construction Supervisor can be found under **Annexure B**.

5. Documentation and Procedures

All required documentation for the construction work, shall be kept in the Health and Safety File, which shall be available on site. The Construction Supervisor shall be responsible for the file on site and the Project Manager shall ensure that documentation is valid and up to date.

It is required that the documentation is filed in an orderly fashion for easy access. The following sections are suggested:

1. Company insurances and information

- Letter of good standing

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- Public liability
- Emergency contact numbers
- Notification of construction work
- Company organogram
- Health and Safety policy
- HIV & Aids Policy
- Drug & Alcohol policy
- Personal Protective Equipment Policy

2. Health and safety plan and specifications

3. Appointments

4. Inspection registers and checklists

5. Risk assessments

- Risk matrix
- Risk assessments
- Method statements
- Record of internal training
- Review of risk assessments

6. Safe work procedures

- Safe Working procedure training
- Planned task observations
- Emergency procedures
- Fall protection plan
- Permits to work

7. Incident management

- WCL2 forms
- Annexure 1 forms
- Injury on duty reporting and investigation procedure
- Resumption reports

8. Training records and medical fitness certificates

- Certificates of formal training
- Induction training records
- Medical fitness certificates for all employees

9. Audits

- Client's Health and Safety audits
- Site inspection reports
- Site safety instructions

10. Contractor control

- List of contractor's and type of work
- Contractor appointments
- 37 (2) agreements

11. Health and safety communication

- Toolbox talks to be held weekly
- Health and Safety notice board
- Schedule D
- Memo's to employees

12. OHS Act and Regulations

6. Application of COIDA and OHSA to Construction Work

6.1 Compensation of Occupational Injuries and Diseases Act, Act No. 130 of 1993 (COIDA)

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Every contractor shall provide proof of registration and an updated letter of good standing with the Compensation Commissioner or a licensed compensation insurer.

6.2 Occupational Health and Safety Policy

- Every contractor's Occupational Health and Safety Policy statement should be available for scrutiny and as evidence of their commitment their employees' occupational health and safety and the environment.
- Every contractor's Occupational Health and Safety Policy statement is to be signed off by the Chief Executive Officer.
- Proof of communication to all is to be available on requests.

6.3 Health and Safety Training and Competency

Training of personnel is a necessity and a legal requirement when required. A record of all training shall be kept and provided on request.

6.3.1 Induction Training

- The principal contractor shall be responsible to co-ordinate all inductions on site to ensure that no contractor allows or permits any employee/s or person/s to enter any construction site, unless such employee, visitor or person has undergone induction training which is pertinent to the hazards prevalent on the site at the time of entry.
- Every employee, visitor or person on site shall be in possession of proof of the Health and Safety induction.
- Records of attendance shall be kept on the Health and Safety file for the duration of the contract.

6.3.2 Awareness Training

- Awareness training to be carried out weekly in the form of Toolbox Talks on relevant topics e.g. manual lifting, wearing PPE, safe use of portable electric tools etc.
- All attendees are to be made to sign an attendance register and such register is to be held on the Health and Safety file for the duration of the project.

6.3.3 Competency and CV's

- All supervisors and where applicable, valid copies of certificates of competency of appointed personnel to be provided and kept in the Health and Safety file. (Reference can be made to pages 10, 11 and 12 of this document).
- Other training requirements such as those identified through the High-risk Assessment process, to be completed and proof of that training also kept in the Health and Safety File.
- Where competency is achieved through experience, a brief CV will be required.

6.3.4 Specific OH&S training

- Valid certificates of training from registered service providers preferably accredited by the appropriate SETA are required for First Aiders, H&S reps, Fire Fighters etc.

6.3.5 Medical Fitness

- All work in elevated positions [tower crane operators, workers on elevated structures requiring fall protection, suspended platform workers and;

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- Operators of construction vehicles and mobile plant require certificates of physical and psychological fitness carried out by an occupational medical practitioner.
- All employees who are employed in a construction site must have medical Fitness done by an Occupational Health & safety Practitioner before commencement of work.
- No employee will be allowed to perform any duties except deemed to be medical fit to do so.

6.4 Health and Safety Reps [OHSA 17 and 18]

- Where 20 or more employees are employed at a workplace, one health and safety representative shall be appointed in writing.
- The Principal Contractor shall ensure that a minimum of one health and safety representative is appointed for ratio of each 50 employees employed.
- Each health and safety representative shall be in possession of a certificate of competency.
- The employer is to ensure that a delegation process has been followed and recorded in term of the requirement of General Administrative Regulation 6
- Monthly checks are to be conducted by the appointed representatives in their designated areas and all finding are to be recorded in a register. Such register is to be held on the health and safety file for the duration of the project.
- Health and Safety Representative are to investigate any staff complaints and ensure that documented feedback is forwarded to the respective managers.

6.5 Health and Safety Committee [OHSA 19 and 20]

- Where two or more representatives have been appointed the employer shall ensure that a health and safety committee is formed.
- The number of management representatives shall not outweigh the number of representatives.
- Meetings shall be held at a minimum of three monthly.
- Minutes of such meeting shall be kept and place on the health and safety file for the duration of the project.
- A register of attendance is to be kept of attendees at such meetings; such a register is to be attached to the minutes.

6.6 General Record Keeping

All contractors shall ensure that all Health and Safety records, required by OHSA and Regulations are kept up to date for reference purposes and auditing.

6.6.1 Inspections

- All contractors shall keep all records of inspections undertaken during the duration of the project.
- An example of the total list of minimum legally required inspections can be found under **Annexure C**.
- An assessment list must be draft of what inspections are required and their frequency.
- The principal contractor is responsible to ensure compliance to this requirement by all contractors.

6.6.2 Audits

- The client's agent shall carry out regular audits on the principal contractor at least once per month.
- Principal contractors shall be responsible for carrying out regular audits on their

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contractors at least once per month

- The Principal contractor is to draft a table which reflects contractors company name, description of work, dates of audits and scores achieved.
- The results shall be tabled for action and discussed at the Health and Safety Committee meetings or the site meetings, as appropriate.

6.7 Incident management and emergency plans

- The principal contractor shall create an Emergency Plan for the construction site.
- The plan is to be clearly displayed in conspicuous locations around the site.
- The plan shall be clearly laid out for all types of emergencies including responsibilities, evacuation routes, siren, emergency no."s etc.
- The plan shall be fully explained to all personnel during the induction training.
- All contractors will become completely familiar with the requirements of the plan and will participate in any evacuation drills that may take place

6.7.1 First Aid [GSR 3]

- Where an employer has 5 or more employees in his employment, he/she shall ensure that at least one first aid box is made available in the workplace.
- Such first aid box is to be stocked covering the 18 items addressed in the Annexure attached to the General Safety Regulations as a minimum requirement.
- Where an employer has 10 employees or more in his/her employment, he/she shall ensure the at least one person readily available at the workplace whom is in possession of a valid first aid certificate.
- Every employer shall ensure that a minimum of one trained persons is made available for every 50 person in the workplace.
- All identified hazardous chemical are to have a material safety data sheet which is to be kept for first aid emergencies in the first aid box.
- All special needs addressed in the Material Safety Data Sheets are to be made available in addition to stock required in the Annexure.

6.7.2 Incidents and Injuries

Incidents

- A record of all incidents which have occurred shall be opened and held open until the handover of the project.
- All incidents such as near misses, unsafe situations, first aid injuries, etc shall be investigated fully and the result of such investigation shared with the Health and Safety Committee.
- The employer shall ensure that an investigation team is formulated which will consist of management representative, safety representative and an employee representative as a minimum requirement.
- All incidents that occur shall be filtered into a statistic format which is to determine the sites Incident Rate. Such rate is to be shared with all employees and all contractors on a monthly basis.
- Exclusion of incidents in record keeping shall result in fines being issued.

Injuries

- A first aid register is to be held in the first aid box as to record all first aid injuries that may occur.

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- An injury on duty procedure is to be created which detail the process of treating an injured and methodology which may be use in order to ensure their safe arrival at a local hospital.
- All injuries are to be recorded in an Annexure 1

6.7.3 Accident and Incident Reporting and Investigation

Should an incident or accident investigation need to be conducted, the appointed incident investigator (competent person with a valid certificate of training on file) shall conduct the said investigation. The procedure to be followed will be in accordance with Annexure 1 of GAR 9 – “Recording and Investigation of incidents”. A copy of this annexure can be found under **Annexure D** in this document.

Particular attention is also drawn to OHSA 24, the reporting of certain incidents to an inspector of the Department of Labour.

The principal contractor shall ensure that the investigations are kept for record purposes and he shall ensure that the outcome of the investigation is communicated to all affected parties as required i.e. the client and contractors.

The client reserves the right to participate in all investigations into accidents or incidents and to conduct their own investigation if required.

6.8 Contractors and suppliers [OHSA 37(2)]

The client shall enter into an “Agreement with Mandatory” in terms of Section 37(2) of the Occupational Health and Safety Act, 85 of 1993, with all appointed principal contractors, a copy of which can be found under **Annexure E**. Likewise all principal contractors shall enter into a similar agreement with all contractors, sub-contracted to them for any period of the contract. Please note that if contractors hire any construction vehicles or mobile plant, the companies from which the equipment is hired must provide any maintenance and test certification as required. In addition, if operators are hired with the equipment, proof of competence and medical certification must be provided.

The principal contractor shall ensure that all contractors are issued with this safety specification where reasonably practicable including any contractor pack for the project, should they not be contained in the safety specification.

The principal contractor shall assist and ensure that contractors engaged comply with all of these requirements and adhere to the requirements set out in the OHSA. Contractors will be stopped from working in the event of unsafe conditions and activities being observed.

All contractors shall be subject to the requirements specified in the HSP and will be issued with a copy of the plan. If the contractor is not able to comply with the requirements set out in the plan, he shall not be appointed as contractor.

6.9 Personal Protective Equipment, Intoxication, Signage and Access Control [GSR 2]

6.9.1 Personal Protective Equipment (PPE) [GSR 2]

- The principal contractor shall through the Risk Assessment process identify all specific PPE needs per each activity. Such identified PPE shall be captured in the form of a PPE matrix and displayed in the site office. Such matrix is to make reference to the task and the specific PPE requirements required to do the task.
- All Contractors will be responsible for the issuing of the required PPE as identified by the matrix.
- Should PPE be lost or stolen, then the employee will be issued with new PPE.
- No person/s shall be permitted entry into the site unless they are properly equipped with the required PPE as identified in the matrix.
- Should PPE be worn out or damaged, the user shall return the worn or damaged PPE and will be issued with a replacement.
- Training in the use, care and limitation of such PPE is to be provided and proof of such

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training is to be held in the health and safety file.

- Visitors shall be informed of PPE requirements **prior** to their visit so that they may make necessary arrangements to ensure their arrival well equipped with the correct PPE.

6.9.2 Intoxication [GSR 2A]

The principal contractor shall be responsible to ensure that no persons may enter or remain at the construction site if under or apparently under the influence of intoxicating liquor or drugs. It may become necessary from time to time for contractors and their workers could be required to do a breathalyser test before entering the site.

6.9.3 Display of signs [GSR 2B]

The principal contractor should make use of signage to assist in enforcing compliance to any requirement specified in this document or as required by law. Standard symbolic signs are acceptable for conveying these requirements where applicable.

6.9.4 Access control [GSR 2C]

The principal contractor shall be responsible to ensure control of access to all persons entering the construction site. The reasons for this are as follows:

- The principal contractor is the „employer“ on the site and for all intents and purposes is responsible for section 8 of OHSA for employees and contractors and section 9 for any other person on site such as visitors and inspectors
- All persons entering the site must undergo induction training to inform them of the hazards present on the site. This includes contractors, visitors, inspectors etc
- The construction supervisor will be aware of who is on site and their function
- The construction supervisor will be able to control tasks that may impact on other work being carried out on the site by a permit to work system
- The number of people and their purpose on the site must be known in case of emergency and evacuation security reasons

The principal contractor shall post conspicuous notices at the site informing all those entering the site of these requirements

6.10 Ladders [GSR 13A]

The following requirements shall be complied with regarding Ladders and Ladder work:

- A competent person shall be identified and appointed as the ladder inspector.
- Where aluminium ladders cannot be used, then wooden ladders shall be straight grained, unpainted to allow for proper inspection of the grain for cracking.
- Ladders shall be secured at the top and chocked at the base to prevent slipping.
- Where chocking of the base is not possible, then the user shall ensure that the ladder is held in position by another employee when ascending the ladder.
- No person is permitted to work longer than 15 minutes on a ladder. Should work take longer than 15 minutes to complete then alternative means of elevation is to be used.
- Ladders shall be inspected a minimum once per month and results recorded in a register by the person appointed as the ladder inspector.
- Proper storage shall be provided for all ladders when not in use.

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6.11 Portable Electrical Tools [EMR 9]

This regulation shall be complied to as a minimum requirement. Regular inspections of all Portable Electrical Tools such as drills, angle grinders etc, shall be carried out. In particular:

- Only trained personnel shall operate such equipment.
- The Construction Supervisor shall ensure operation of the equipment is in accordance the HRA requirements and Safe Working Procedure (SWP).
- All users shall undergo regular awareness training (toolbox talk) to ensure compliance.
- The Construction Supervisor shall ensure the required PPE is used.

6.12 Permit to work

The permit holder shall be responsible to ensure that:

- All work being carried out on the site has been approved through the necessary project control system
- All work is being done in compliance with the issued permits.
- Permits required from third parties such as town councils for utility and sewage services are in place
- A permit system is operational so that work consisting of many tasks related to the construction on site, can be carried out without endangering the health and safety of personnel on site, neighbours and the public surrounding the site and/or causing damage to property.
- In particular, attention is drawn to GSR 9, which details the requirements for welding, flame cutting, soldering and similar operations (hot work)

6.13 Work in confined spaces

The permit holder shall be responsible to ensure that:

- All work being carried out on the site has been approved the necessary project control system
- All work is being done in compliance with the issued permits.
- Permits required from third parties such as town councils for utility and sewage services are in place

7. Application of the Construction Regulations [CR]

[Please note: this is the complete list. Item 7.1 is compulsory and the rest are applicable if relevant to the work being carried out]

7.1 Hazard Identification, Risk Assessment and Risk Control (HIRA) [CR 9]

- The contractor shall prior to the commencement of any construction work perform a HIRA exercise, which will form part of the HSP for the project.
- A copy of the HIRA shall be made available for viewing to the client's agent and shall be kept in the Health and Safety File.
- The contractor shall ensure that the outcome of all HIRA exercises will be conveyed to all relevant employees with respect to the hazards and the related control measures before any work commences.

The control of several of these risks may be specified in the OHSA does not mean that the HIRA exercise does not have to be carried out.

7.2 Fall Protection [CR 10]

Section 1 (a) of this regulation states that a contractor shall cause the designation of a competent person, responsible for the preparation of a fall protection plan. The control of several of these risks may be specified in the OHSA or the CR but this does not mean that the HIRA exercise does not have to be carried out.

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7.3 Structures [CR 11]

The appointed civil contractor shall meet the requirements of this regulation. Attention is drawn, which requires the designer to inspect the structure at appropriate times and the record of these inspections to be available on site.

7.4 Excavations [CR 13]

Section 1 of this regulation states that this work must be carried out under the supervision of a competent person who has been appointed in writing. All the requirements of CR 13 shall be met. For inspection of excavations, attention is drawn to section 3 (h), the records of which must be available on site.

7.5 Construction vehicles and mobile plant [CR 23]

It will be the responsibility of each contractor on site to ensure compliance of their vehicles and mobile plant to these regulations. This includes vehicles to be used for transporting personnel to and from site, which will be subject to relevant requirements such as licensing and roadworthiness checks. In addition the following will apply:

- Safe transport for personnel working on the project to and from the workplace, which shall include proper seating, side restraints and cover.
- Road safety principles shall be adhered to on and off staff.

If a mobile crane or other mobile plant is hired, only approved hire companies shall be contracted to provide such equipment. The Construction Supervisor shall ensure compliance of the provider to these regulations. In particular, attention is drawn to the competence and fitness of the operator [section 1 (d)] and the inspection of the equipment [section 1 (j)]

7.6 Temporal Electrical installations[CR 24], including [EIR] and [EMR]

The requirements of these regulations shall be met as required, by the appointed electrical contractor. A competent person will be appointed for inspection and control of all temporary electrical installations as per CR 24 (d) and (e) respectively.

7.7 Water Environments [CR 26]

The requirements of this regulation shall be met.

7.8 Housekeeping [CR 27] including [ERW(6)]

All contractors shall ensure that housekeeping standards as per these regulations shall be maintained at all times.

7.9 Stacking of Materials [CR 28] including [GSR (8)]

All contractors shall ensure that materials are only stored in defined and allocated storage areas and that materials being stored are stacked in accordance with sound stacking principles as per these regulations.

7.10 Fire Precautions [CR 29]

All contractors on site will comply fully with the requirements of this regulation. In particular, the principal contractor will be responsible for the evacuation plan (section (I)) the details of which will be imparted to contractors, visitors etc through the site induction.

7.11 Construction welfare facilities [CR 230]

The principal contractors shall be responsible for implementing this regulation and shall ensure that adequate facilities are provided for the personnel on site in terms of the following:

- Change room facilities
- Sheltered eating area
- Adequate toilets
- Hand wash facility
- Potable water.

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No food preparation shall be conducted on site. Eating and drinking will only be permitted in the designated eating areas, which must be provided with adequate seating. Waste bins shall be strategically placed and clearly regularly.

8 Site-specific and Design Risks

Please note: this is not a complete or exhaustive list. The principal contractor is expected to assess all risks to which his employees may be exposed during the construction and/or demolition process, as well as the hazards identified and listed below.

The following jobs or activities are classified as High

- Confined Space Entry
- Excavation
- Construction vehicles and mobile plant
- Traffic accommodation
- Pouring Concrete
- Working at Heights

8.1 Hazard Identification and Risk Assessment Methodology

8.1.1 Baseline Risk Assessment

A Baseline Hazard Identification and Risk Assessment must be carried out during the preliminary stages of the construction/demolition project for the purposes of attempting to reduce the possibility of accidents or ill health occurring.

Taking into account the constraints of time and resources, every effort must be made to identify the hazards and recommend possible solutions. It is not reasonably practicable to expect the baseline risk assessment to identify all hazards, which is why task risk assessments are carried out on site.

8.1.2 Task risk assessment

Once on site, every contractor shall perform task risk assessments, using the baseline risk assessment as a guide.

The Risk Assessment should be reviewed once on site and thereafter after any incident or every one-year period, whichever occurs first. Additional hazards highlighted or a change in the risk factor should have a separate risk assessment carried out and filed.

The Risk Assessment is based on the combination of the CONSEQUENCE and PROBABILITY associated with each hazard.

8.1.3 Definitions

<i>Term</i>	<i>Meaning</i>
HAZARD:	Anything that can cause harm
RISK:	The chance, great or small, that someone will be harmed by the hazard
CONSEQUENCE:	The possible outcome of an accident / incident, e.g. broken leg, explosion
PROBABILITY:	The possibility of the accident / incident occurring

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8.1.4 Risk assessment

The following evaluation must be used to determine risk:
 Probability X Consequence = RISK

Risk Matrix:

Consequence	(3) Critical (Fatal/Permanent Disabling Injury)	(3) Medium risk	(6) High risk	(9) CRITICAL
	(2) Major (Temporary Disabling Injury)	(2) Low risk	(4) Medium risk	(6) High risk
	(1) Manageable	(1) Low risk	(2) Low risk	(3) Medium risk
		(1) Remote	(2) Possible	(3) Likely
		Probability (Likelihood)		

RED = High Risk (6 – 9)
 ORANGE = Medium Risk (3 – 4)
 GREEN = Low Risk (1 – 2)

Activity	Hazard	Risk Eval.	Precautions and Control Measures
			1. Eliminate the risk 2. Control the risk at its source 3. Follow a safe working procedure 4. Provide PPE
1. describe task	Hazard 1	9, 6, 4, 3, 2, or 1	- Precaution 1 - Precaution 2 - Etc.
	Hazard 2		- Precaution 1 - Precaution 2 - Etc.

8.2 Site-specific risks

The following site-specific risks have been identified for this project. These must be catered for in the contractor's health and safety plan (that which is applicable to their scope of work), and included in the site-

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specific risk assessment:

8.2.1 Traffic – restrictions, existing systems, site traffic

Traffic accommodation must be arranged with the principal agent.

8.2.2 Site security and access –

This is controlled by the individual contractor responsible.

8.3 Design risks

The following design risks have been identified by the designer for this project. These must be catered for in the contractor's health and safety plan (that which is applicable to their scope of work), and included in the site-specific risk assessment:

8.3.1 Excavations

8.3.2 Traffic Accommodation

8.3.3 Vehicle and mobile plants

9 Fines and Penalties

9.1 Minor Health or Safety Transgression

Not wearing PPE; e.g. safety helmet, eye protection, high visibility vests or foot protection. Fine: R1000-00 will be issued to the contractor.

9.2 Serious Health or Safety Transgression

Not contributing to good housekeeping practices, improper stacking and storage, lack of supervision on site, failure to carry out risk assessments for tasks or activities, failure to carry out toolbox talks, failure to train employees in risk assessments and/or safe work procedures, failure to issue PPE to employees. Fine: R2000-00 will be issued to the contractor

9.3 Major Health or Safety Transgression

A life-threatening activity, condition, act or contribution by an employee in creating an unsafe working environment for himself or herself or other persons, failure to wear critical PPE (safety harness, eye protection, respiratory equipment, or as stipulated in the risk assessment).

Fine: Up to R3000.00 will be issued to the contractor

9.4 Repeat Offences

A contractor that receives more than three (3) major transgressions for the same offence and may, at the discretion of the project manager, be required to leave site

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ANNEXURE A (Notification of Intention to Commence Construction Work)

ANNEXURE 2

NOTIFICATION OF CONSTRUCTION WORK

Regulation 4 of the Construction Regulations, 2014

1. (a) Name and postal address of principal contractor:
(b) Name and telephone number of principal contractor's contact person:
2. Principal contractor's compensation registration number:
3. (a) Name and postal address of client:
(b) Name and telephone number of client's contact person or agent:
4. (a) Name and postal address of designer(s) for the project:
(b) Name and telephone number of designer's contact person:
5. Name and telephone number of principal contractor's construction manager on site appointed in terms of regulation 8(1):
6. Name/s of principal contractor's sub-ordinate manager on site appointed in terms of regulation 8(2):
7. Exact physical address of the construction site or site office:
8. Nature of the construction work:
9. Expected commencement date:
10. Expected completion date:
 1. Estimated maximum number of persons on the construction site:
 - Total _____ Male _____ Female _____
 -
12. Planned number of contractors on the construction site accountable to principle contractor:
13. Name(s) of contractors already chosen:

Principal contractor

Date

Client

Date

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ANNEXURE B (Example: Appointment - Construction Supervisor)

APPOINTMENT OF A CONSTRUCTION MANAGER

CONSTRUCTION REGULATION 8 (1)

8(1) The contractor shall appoint a full time, competent employee in writing as the construction supervisor with the duty of supervising construction work

APPOINTMENT

I, _____ (contractor's name), having been appointed in terms of section 16 (2) of the Occupational Health and Safety Act (85 of 1993) to ensure full compliance with the Act, do hereby appoint:

_____ (name of appointee), being a full-time employee, as the
Construction Manager responsible for:

_____ (site address)
,to supervise construction work for the duration of the project/ contract or until you are relocated to another site/ project or leave the employ of the company.

You are reminded that you are required to be conversant with all relevant statutory provisions and regulations of the Occupational Health and Safety Act (85 of 1993) in the regard to carrying out of construction work.

Signature _____ Date _____

Designation _____

ACCEPTANCE

I, _____ (name of appointee)
hereby accept and understand the requirements of this appointment as **Construction Manager** and confirm that I have the necessary competence required and that I am conversant with all the relevant statutory provisions of the Occupational Health and Safety Act (85 of 1993).

Signature _____ Date _____

Designation _____

Certificate(s)
Training&CV _____

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ANNEXURE C Inspection List

Inspections Required

No.	Inspection	By who	Frequency	Record
1	Excavations	Appointed Person	Daily before shift, plus other	Checklist
2	Construction Vehicles and Mobile Plant	Appointed Person	Daily	Inventory/ checklist
3	Electrical Installations (temporary)	Appointed Person	Weekly	Inventory/ checklist
4	Fire Equipment	Appointed Person	Manufacturer's spec	Inventory/ checklist
5	First Aid Box Contents	First Aider	Monthly	Inventory
6	Ladders	Competent Person	Monthly	Inventory/ checklist
7	Lifting Tackle	Appointed Person	3- monthly	Inventory/ checklist
8	Hand Tools	Appointed Person	Monthly	Inventory/ checklist
9	Portable Electrical Equipment	Appointed Person	Monthly	Inventory/ checklist
10	Health & Safety Rep	H&S Rep/ Safety Officer	Monthly	Checklist
11	Good Housekeeping	H&S Rep/ Safety Officer	Monthly	Report
12	Stacking and Storage	Appointed Person	Monthly	Report
13	Change Rooms and Toilets	H&S Rep/ Safety Officer	Monthly	Inventory/ checklist
14	Pneumatic Tools	Appointed Person	Monthly	Inventory/ checklist

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ANNEXURE D (Recording and Investigation of Incidents)

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993(ACT NO 85 OF 1993)

REGULATION 9 OF THE GENERAL ADMINISTRATIVE REGULATIONS

RECORDING AND INVESTIGATION OF INCIDENTS

A. RECORDING OF INCIDENT

1. Name of Employer _____
2. Name of affected person _____
3. Identity Number of affected person _____
4. Date of incident _____
5. Time of Incident _____

6. Part of the body affected*

Head or neck	Eye	Trunk	Finger	Head	
Arm	Foot	Leg	Internal	Multiple	
Sprains or strains	Contusions or wounds	Fractures	Burns	Amputation	
Electric Shock	Asphyxiation	Unconsciousness	Poisoning	Occupational Diseases	
0-13 days	2-4 weeks	>4-16 weeks	>16-52 weeks	>52 weeks or permanent disablement	Killed

8. Expected period of
disablement.*

9. Description of Occupational disease** _____

10. Machine/ process involved/ type of work performed/ exposure* _____

11. Was the incident reported to the Compensation Commissioner and Provincial Director?

Yes	No

Make a cross in the appropriate square

12. Was the incident reported to the Police?

Yes	No

13. SAPS office and reference _____

- *To be completed in case of a fatal incident
- **in case of a hazardous chemical substance, indicate substance exposed to.

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B. INVESTIGATION OF THE ABOVE INCIDENT BY A PERSON DESIGNATED THERETO

1 Name of investigator _____ 2 Date of investigation _____

3 Designation of investigator

4 Short Description of incident

5 Suspected cause of incident

6. Recommended steps to prevent a recurrence

Signature of investigator

Date

C. ACTION TAKEN BY THE EMPLOYER TO PREVENT THE RECURRENCE OF A SIMILAR INCIDENT

Signature of investigator

Date

D. REMARKS BY HEALTH AND SAFETY COMMITTEE

Remarks _____

Signature of chairperson of health and safety committee

Date

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ANNEXURE E (Section 37(2) – Agreement with Mandatory)

AGREEMENT WITH MANDATORY

OCCUPATIONAL HEALTH AND SAFETY ACT, (Act No 85 of 1993)

AGREEMENT WITH MANDATORY In terms of Section 37(1) and (2)

WRITTEN AGREEMENT ENTERED INTO AND BETWEEN

(Hereinafter referred to as the Company) AND

CONTRACTOR

(Hereinafter referred to as The Contractor) Compensation Fund Number:

AGREEMENT WITH MANDATORY TO BE COMPLETED IN BLACK INK. INITIAL EACH PAGE AND ANY CHANGES.

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Definition of MANDATORY

Includes an agent, a contractor or sub-contractor for work, but without derogating from his status in his own right as an employer or user.

Occupational Health and Safety Act (No. 85 of 1993)

1. You are requested to, as far as you reasonably can, comply with the requirements of the OHS ACT and Regulations.
2. Your attention is drawn to “**General Duties of Employers to their Employees**” as required by Sect 8 of the Act.
3. You are required to:

3.1 Sign a written “**Agreement with Mandatory**” as required by Sect 37(1)(2) of the Act with us before you commence any work on my / our premises / site.

3.2 Provide the **client / principal contractor** with a documented health and safety plan.

3.3 Provide the **client / principal contractor** with written appointment of the person who is going to supervise the construction work as per Construction Regulation 6(1).

Note: Electrician to provide copy of certificate of registration as per Elect. Install Reg. 9(3).

3.4 Provide the **client / principal contractor** with written designation of your nominated Health and Safety Representative as per Sect 17(1).

3.5 If you employ more than five (5) persons, you are required to provide your own First Aid Box. (General Safety Regulation 3 (2).)

3.6 If you employ more than ten (10) persons, you are required to provide your own qualified First Aider as per General Safety Regulation 3(4).

3.7 When working with hazardous chemical substances, comply with Hazardous Chemical Substances Regulation

3. *Note: Asbestos and Lead regulations are separate.*

3.8 When using a Materials Hoist , comply with Construction Regulation 17.

3.9 When using Lifting Machines and Lifting Tackle, comply with Driven Machinery Regulation 18.

3.10 When using Explosive Powered Tools, comply with Construction Regulation 19.

3.11 When using Scaffolding, Formwork and support work, comply with Construction Regulation 10 and 14.

3.12 When Excavating or Demolishing, comply with Construction Regulation 11 and 12.

3.13 When Welding, Flame Cutting, Soldering, comply with General Safety Regulation 9.

3.14 When working in confined spaces, comply with General Safety Regulation 5.

4. You are responsible for providing your own **legal safety documents and registers** to comply with the Act's requirements. *A copy of the OHS Act of 1993 should be available in the main contractors office.*

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5. You are required to comply with General Safety Regulation 2(1) to (7) and provide employees with: personal protective equipment which will allow them to carry out their work in a safe manner, e.g. hard hats, safety belts, gloves, safe footwear, eye protection, ear protection, waterproof clothing etc.

5. Reporting of Incidents and Occupational Diseases shall be done as per General Admin. Regulation 6. (Also see Sect 24 of the Act.)

Compensation for Occupational Injuries and Diseases Act (No 130 of 1993)

You are required to provide the **client** proof of registration with the Compensation Commissioner/Federated Employer's Mutual within seven (7) days after signing this agreement. Failure to do so would result in the **client** notifying the agent of the Commissioner to investigate and make an assessment of your wage return and the applicable levy you have to pay, which will be liable for a deduction from your monthly progress payments and paid over to the Commissioner. (Copies of proof of payment will be provided to the contractor)
See Section 89(1) of the COID

THE CONTRACT

PART C3: SCOPE OF WORKS

Particular Specifications

Portion 2

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OCSD SPECIFICATIONS

PSDAM 2 SITE INVESTIGATIONS AND VERIFICATION
PSDAM 3 CLEARING AND GRUBBING
PSDAM 4 FOUNDATION EXCAVATION
PSDAM 5 FOUNDATION TREATMENT
PSDAM 6 CUT-OFF TRENCH
PSDAM 7 BORROW AREAS AND QUARRY MATERIALS
PSDAM 8: DAM EMBANKMENT EARTHWORKS
PSDAM 9 – IMPERVIOUS CORE CONSTRUCTION
PSDAM 10 – FILTER AND TRANSITION ZONES
PSDAM 11 – ROCKFILL AND SHELL ZONES
PSDAM 12 – INTERNAL DRAINAGE SYSTEM (CHIMNEY DRAIN, BLANKET DRAIN AND TOE DRAIN)
PSDAM 13 – RIPRAP AND SLOPE PROTECTION
PSDAM 14 – SPILLWAY WORKS
PSDAM 15 FORMWORK, BRIDGE BEARINGS AND WATERSTOPS

SPECIFICATION FOR WEIR AND OCSD

PSG – FORMWORK, WATERSTOPS AND CONSTRUCTION JOINTS
PSBL – BLASTING WORKS
PSM – STRUCTURAL STEELWORK AND METALWORK

SPECIFICATION FOR WEIR

PSW 1 – GENERAL REQUIREMENTS
PSW 2 – SITE INVESTIGATIONS AND VERIFICATION
PSW 3 – RIVER DIVERSION WORKS
PSW 4 – FOUNDATION EXCAVATION
PSW 5 – FOUNDATION TREATMENT
PSW 6 – GROUT CURTAIN
PSW 7 – STRUCTURAL CONCRETE
PSW 8 – REINFORCEMENT
PSW 9 – JOINTS AND WATERSTOPS
PSW 10 – SCOUR OUTLET SYSTEM
PSW 11 – ABSTRACTION WORKS
PSW 12 – DN600 TRANSFER PIPELINE CONNECTION
PSW 13 – ENERGY DISSIPATION WORKS
PSW 14 – EROSION PROTECTION
PSW 15 – INSTRUMENTATION AND MONITORING
PSW 16 – TESTING, COMMISSIONING AND HANDOVER

ROAD AND BRIDGES SPECIFICATION

P PSRD – ACCESS ROADS, DRAINAGE AND ROADWORKS
SAT – ACCOMMODATION OF TRAFFIC
PSBR – BRIDGE WORKS

MECHANICAL AND ELECTRICAL SPECIFICATION

ME: MECHANICAL SPECIFICATION
PSEL: ELECTRICAL SPECIFICATION
PSLE 2 DESIGN BUILT BY NOMINATED SUBCONTRACTOR BULK ELECTRICAL

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PROJECT SPECIFICATIONS

PORTION 2: VARIATIONS AND ADDITIONS TO THE SPECIFICATIONS

The following variations and additions to the SANS 1200 and other Standardised Specifications referred to in the last clause of Portion 1 apply to this Contract. The prefix PS indicates an amendment to the referred specification. This section relates to proposed Mechanical and Electrical Installation to be undertaken by a nominated sub-contractor approved by the Employer and the Employers Agent.

STATUS

Should any requirement of the Project Specification conflict with any requirement of the standardized and particular specifications, the requirements of the Project Specifications shall prevail.

PSA GENERAL JOINTS

PSA1 SPECIFICATION DRAWINGS (Clause 2.7)

Specification Drawings may be included in this document as annexure to the Project and Particular Specifications. Where such Specification Drawings depict items and standard structures according to layouts and details differing from those shown in the Standardised Specifications, the layouts and details shown in the annexure to the Project and Particular Specifications shall be adopted.

PSA2 QUALITY (Clause 3.1)

All material used in the Works shall, where such mark has been awarded for a specific type of material, bear the SABS mark. Alternatively, the Contractor shall furnish the Engineer with certificates of compliance of materials, which bear the official mark of the appropriate standard.

PSA2.1 DEFINITIONS

PSA2.1 Definitions

Add the following:

Task	- a quantified activity or operation.
Daily task	- a task that is required to be completed within a working day.
Task remuneration	- remuneration as paid for a completed task or job.
Daily rate	- the remuneration of a day's work.
Daily wage	- see daily rate.
Daily task remuneration	- the remuneration for a completed daily task.
Labour-intensive construction	- the economically efficient employment of as great a portion of labour as is technically feasible to produce as high a standard of construction as demanded by the specifications and allowed by the funding available, thus the effective substitution of labour for equipment.

(Note: This definition is not Contract specific but applies to the project as a whole. This Contract is a part of such a project).

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PSA3 BEACONS AND PEGS (Sub-Clause 5.1.2)

The Contractor shall be responsible for the safeguarding of all survey reference marks and erf boundary pegs.

PSA4 WATCHING BARRICADING, LIGHTING, SIGNAGE AND TRAFFIC CROSSINGS

While the responsibility for the efficient barricading, signage, lighting and watching of all trenches and stacks of material shall rest upon the Contractor, he shall be required to make the following minimum provisions in this respect.

Where a vehicular or pedestrian crossing is required over an open trench, it shall be protected on each side by a stout two-rail fence, at least 1m high, consisting of 150 x 75mm deal vertical set 0,6m into the ground, with 75 x 50 mm rails securely nailed to them. Where deals or board are used as bridges, they must be battened underneath to prevent tipping.

The Contractor shall make available on the site at all times a sufficient number of steel plates at least 2m by 1m by 81mm thick, complete with approved suitably sized barriers at spacing which will accommodate the most likely traffic loading for this area, which may be laid across open excavated trenches to provide bridges for vehicles along the trafficked route of the work as and where this may be considered necessary by the Engineer.

Appropriate signage in accordance with the Local Traffic Authority and at least four lamps must be provided at each trafficked crossing. The spacing between lamps along an open trench running longitudinally in a road shall be not greater than 20 meters, lamps shall be kept in good order and continuously lit from dusk to dawn.

PSA5 SERVICES (Sub-Clause 5.4)

Protection: Where, in the course of excavation, the Contractor shall lay bare any water mains, pipes, cables, telegraph or telephone poles, or any existing structures, these shall be securely shored, shuttered or slung and sufficiently protected to ensure that no damage shall be done to them until filling has been placed around them. In the case of electric and telephone cables, if these shall be exposed in the course of excavation, the Contractor shall not refill the excavation around such cables until the cables have been inspected and passed as intact by their respective owners. (Also refer to Project Specifications PS 10.2 and PSDB3.)

PSA6 GROUND AND ACCESS TO WORKS (Sub-Clause 5.8)

While the accompanying plan shows the routes of the services and generally indicates the roads available, it does not purport to give full information with regard to the most suitable means of access to the Site. At all times during the execution of the Contract, the Contractor shall be responsible for the closing of all gates and for the proper protection of property of every description which may have been entered upon or interfered with in any way by him in carrying out the Works. All fences and other structures that have been damaged or interfered with by the Contractor shall be restored to a condition at least equivalent to their original condition.

PSA7 SITE CORRESPONDENCE

PSA7.1 Instructions by the Engineer

Site instructions by the Engineer, addressed to the Contractor at his office on the Site, will be numbered consecutively and will be deemed to have been received by the Contractor's Representative unless a break in the sequence of numbers is brought to the notice of the Engineer in writing immediately.

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PSA7.2 Site Diary

A site diary, which will be supplied by the Engineer, must be filled in on a daily basis and submitted to the Engineer on a monthly basis. No claims will be considered without the site diary's schedule properly completed (on a daily basis) and submitted.

PSA8 SITE MEETINGS

The Contractor and his authorised representative shall attend all meetings held on the Site with the Employer and the professional team at dates and times to be determined by the Engineer. Such meetings will be held to evaluate the progress of the Contract, and to discuss matters pertaining to the Contract which any of the parties represented may wish to raise. It is not the intention to discuss day-to-day technical matters at such meetings.

PSA9 SUMS STATED PROVISIONALLY (Clause 8.5)

PSA9.1 Contingencies

No percentage mark-up will be applicable to any payments made using contingency money other than those included in prices for variations determined in terms of the Conditions of Contract.

PSA9.2 Contract Price Adjustment

As per formula in General Conditions of Contract 2025

PSDAM 1 GENERAL REQUIREMENTS

PSDAM 1.1 SCOPE OF WORKS

This specification covers the construction of the Empuluzi Off-Channel Storage Dam (OCSD), including all excavation, foundation preparation, foundation treatment, cut-off trench construction, embankment construction, filter and drainage zones, riprap protection, spillway works, intake tower, outlet works, instrumentation, ancillary structures, testing, commissioning, and all associated works required for the completion of the Dam.

The Works shall be executed in accordance with the Drawings, Specifications, Geotechnical Investigation Reports, Design Reports, Environmental Authorisation Conditions, Dam Safety Requirements, and the Contract Documents.

PSDAM 1.2 APPLICABLE STANDARDS

Unless otherwise specified, all materials, workmanship, testing, inspection, measurement and construction activities shall comply with the latest applicable editions of:

- (a) SANS 1200 Standardized Specifications for Civil Engineering Construction;
- (b) SANS 1921 Construction and Management Requirements;
- (c) SANS 10100 (where applicable);
- (d) Relevant SANS specifications for earthworks, concrete, pipes, geosynthetics and testing;
- (e) Department of Water and Sanitation Dam Safety Requirements;
- (f) Occupational Health and Safety Act and Regulations;
- (g) Environmental Authorisation and Environmental Management Programme (EMPr); and
- (h) Any other standards specifically referenced in the Contract Documents.

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Where a conflict exists between standards, the more stringent requirement shall apply unless otherwise directed by the Employer's Agent

PSDAM 1.3 DAM SAFETY REQUIREMENTS

The Contractor shall execute the Works in a manner that complies with all applicable Dam Safety requirements.

The Contractor shall cooperate fully with the Employer, Employer's Agent, Dam Safety Reviewer, Approved Professional Person (APP), and any authorised representatives of the Department of Water and Sanitation.

No departure from the approved design, drawings, specifications, material requirements, construction methodology, or quality requirements shall be permitted without the prior written approval of the Employer's Agent.

PSDAM 1.4 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall be responsible for:

- (a) Setting out of the Works;
- (b) Temporary works;
- (c) Construction methodology;
- (d) Quality control;
- (e) Testing and inspection;
- (f) Protection of completed works;
- (g) Construction records;
- (h) Health and safety compliance;
- (i) Environmental compliance; and
- (j) Provision of suitably qualified personnel and resources.

The Contractor shall provide all labour, materials, plant, equipment, transport, temporary works, supervision and other resources necessary for the successful completion of the Works.

PSDAM 1.5 CONSTRUCTION PROGRAMME

The Contractor shall submit a detailed construction programme showing all major activities associated with the dam construction works.

The programme shall identify critical construction activities including:

- (a) Foundation excavation;
- (b) Foundation treatment;
- (c) Cut-off trench construction;
- (d) Embankment construction;
- (e) Filter placement;
- (f) Drainage installation;
- (g) Intake tower construction;
- (h) Outlet works;
- (i) Spillway construction; and
- (j) Testing and commissioning.

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The programme shall be updated monthly.

PSDAM 1.6 TEMPORARY WORKS

The Contractor shall design, construct, maintain and remove all temporary works required for the execution of the Contract.

Temporary works may include but shall not be limited to:

- (a) Access roads;
- (b) Construction platforms;
- (c) Temporary drainage systems;
- (d) Dewatering systems;
- (e) Temporary services;
- (f) Temporary stockpile areas;
- (g) Erosion protection measures;
- (h) Temporary safety barriers; and
- (i) Any other works required for construction.

All temporary works shall be designed and executed to ensure the safety of personnel, the public, the environment and the permanent works.

PSDAM 1.7 SURVEY CONTROL AND SETTING OUT

The Contractor shall establish, maintain and protect all survey control points necessary for the execution of the Works.

All setting out shall be undertaken by suitably qualified survey personnel.

The Contractor shall maintain accurate survey records throughout the Contract.

PSDAM 1.8 MATERIALS

Only approved materials complying with the Specifications shall be incorporated into the Works.

The Contractor shall submit material sources, test results, certificates of compliance and samples for approval before use.

The Employer's Agent may reject any material that fails to comply with the Specifications.

PSDAM 1.9 QUALITY CONTROL

The Contractor shall implement and maintain a Quality Management System for the duration of the Contract.

The Contractor shall prepare Inspection and Test Plans (ITPs) for all major construction activities.

No work shall proceed beyond designated Hold Points without approval by the Employer's Agent.

The Contractor shall maintain complete records of inspections, tests, surveys, material approvals and quality control activities.

PSDAM 1.10 ENVIRONMENTAL PROTECTION

The Contractor shall comply with the approved Environmental Management Programme (EMPr) and all environmental authorisations applicable to the Works.

The Contractor shall implement measures to prevent:

- (a) Soil erosion;
- (b) Sedimentation of watercourses;

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- (c) Water pollution;
- (d) Dust generation;
- (e) Noise pollution;
- (f) Damage to vegetation; and
- (g) Disturbance to sensitive environmental areas.

PSDAM 1.11 HEALTH AND SAFETY

The Contractor shall comply with the Occupational Health and Safety Act and all applicable regulations.

The Contractor shall prepare, implement and maintain an approved Health and Safety Plan.

Particular attention shall be given to:

- (a) Excavations;
- (b) Working near water;
- (c) Blasting operations;
- (d) Heavy earthmoving equipment;
- (e) Lifting operations;
- (f) Confined spaces; and
- (g) Construction traffic.

PSDAM 1.12 CONSTRUCTION RECORDS

The Contractor shall maintain detailed construction records including:

- (a) Daily site records;
- (b) Survey records;
- (c) Foundation inspection records;
- (d) Material test results;
- (e) Density test records;
- (f) Concrete records;
- (g) Instrumentation installation records;
- (h) Photographic records; and
- (i) As-built information.

These records shall be made available to the Employer's Agent upon request.

PSDAM 1.13 TESTING AND ACCEPTANCE

All materials and workmanship shall be subject to inspection and testing.

The Contractor shall provide all facilities necessary for testing and inspection.

The Employer's Agent may instruct additional testing where necessary to verify compliance.

Any work failing to comply with the Specifications shall be removed, repaired or replaced at the Contractor's expense.

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PSDAM 1.14 AS-BUILT DOCUMENTATION

The Contractor shall prepare and submit complete as-built records for all dam works.

The as-built documentation shall include drawings, survey information, test records, material certifications, commissioning records, operation manuals, maintenance manuals and all other documentation required by the Employer.

Submission and acceptance of the as-built documentation shall be a prerequisite for Practical Completion and Taking-Over of the Works.

PSDAM 2 SITE INVESTIGATIONS AND VERIFICATION

PSDAM 2.1 SCOPE

This specification covers the verification of site conditions, geological conditions, geotechnical conditions, material sources, groundwater conditions, foundation conditions, and all investigations required during construction to confirm the suitability of the site for the construction of the Off-Channel Storage Dam and associated infrastructure.

PSDAM 2.2 REVIEW OF AVAILABLE INFORMATION

The Employer has made available geotechnical, geological, hydrological, topographical, environmental, and design information upon which the design of the Works has been based.

The Contractor shall study all available information prior to commencing the Works and shall satisfy himself as to the nature of the site conditions, access constraints, construction requirements, foundation conditions, groundwater conditions, borrow material availability, and all other factors that may influence the execution of the Works.

The Contractor shall be deemed to have allowed in his tender for all conditions reasonably foreseeable from the information provided.

PSDAM 2.3 CONTRACTOR'S VERIFICATION OF SITE CONDITIONS

Before commencing major construction activities, the Contractor shall undertake his own verification of the site conditions and shall confirm the suitability of the proposed construction methods, equipment, temporary works, borrow areas, haul routes, stockpile areas, and working platforms.

The Contractor shall promptly notify the Employer's Agent of any discrepancies between actual site conditions and those indicated in the Contract Documents.

No variation to the Works shall be undertaken without the written instruction of the Employer's Agent.

PSDAM 2.4 VERIFICATION OF FOUNDATION CONDITIONS

Following excavation and exposure of foundation areas, the Contractor shall facilitate the inspection and verification of all foundation conditions by the Employer's Agent and the Approved Professional Person (APP) where required.

The exposed foundation shall be examined to confirm:

- (a) The depth and extent of competent founding material;
- (b) The presence of soft zones, unsuitable materials, cavities, voids, faults, joints, seams, solution channels, weathered material, seepage paths, or other adverse geological features;
- (c) The suitability of the foundation for supporting the proposed embankment and structures;
- (d) The extent of foundation treatment required; and
- (e) Compliance with the assumptions adopted in the design.

No foundation area shall be covered by fill, concrete, filter material, drainage material, or any permanent works until written approval has been obtained from the Employer's Agent.

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PSDAM 2.5 GEOLOGICAL MAPPING

All exposed rock foundations, cut-off trench excavations, spillway excavations, intake tower foundations, outlet structure foundations, and other significant excavations shall be mapped by a suitably qualified Geotechnical Engineer where required by the Employer's Agent.

Geological mapping shall record:

- (a) Rock type;
- (b) Degree of weathering;
- (c) Joint orientation and spacing;
- (d) Fracture conditions;
- (e) Faults and shear zones;
- (f) Seepage zones;
- (g) Groundwater conditions;
- (h) Foundation defects; and
- (i) Any other features affecting the design or performance of the Works.

Geological records shall be submitted to the Employer's Agent as part of the permanent project records.

PSDAM 2.6 VERIFICATION OF BORROW AREAS

The Contractor shall verify the suitability of all proposed borrow areas intended for use in the construction of the embankment, core, filters, drains, transition zones, rockfill, riprap, and other earthworks.

Verification shall include:

- (a) Material classification;
- (b) Moisture-density relationships;
- (c) Plasticity characteristics;
- (d) Particle size distribution;
- (e) Permeability characteristics;
- (f) Durability characteristics; and
- (g) Any other testing required by the Specifications.

The Contractor shall not commence production from any borrow area until approval has been obtained from the Employer's Agent.

PSDAM 2.7 VERIFICATION OF CONSTRUCTION MATERIALS

The Contractor shall verify the suitability of all construction materials proposed for incorporation into the Works.

Testing shall be undertaken at frequencies approved by the Employer's Agent and shall include all testing necessary to demonstrate compliance with the Contract Specifications.

Materials requiring verification may include:

- (a) Embankment fill;
- (b) Core material;
- (c) Filter materials;
- (d) Drainage materials;

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- (e) Rockfill;
- (f) Riprap;
- (g) Aggregates;
- (h) Concrete materials;
- (i) Geotextiles;
- (j) Pipes;
- (k) Mechanical equipment; and
- (l) Any other materials specified for the Works.

PSDAM 2.8 GROUNDWATER AND SEEPAGE CONDITIONS

The Contractor shall monitor groundwater levels, seepage conditions, springs, wet areas, and groundwater inflows encountered during construction.

Any groundwater conditions that differ materially from those anticipated in the design shall be reported immediately to the Employer's Agent.

The Contractor shall provide all temporary drainage and dewatering measures necessary to maintain safe and suitable construction conditions.

PSDAM 2.9 TRIAL SECTIONS AND TEST AREAS

Where directed by the Employer's Agent, the Contractor shall construct trial embankment sections, test fills, compaction trials, filter placement trials, concrete trials, or other demonstration sections to verify compliance with the Specifications before commencing full-scale production.

The results of such trials shall be used to establish approved construction procedures, layer thicknesses, moisture conditioning requirements, compaction effort, equipment selection, and quality control requirements.

PSDAM 2.10 REPORTING OF DIFFERING SITE CONDITIONS

Should the Contractor encounter geological, geotechnical, groundwater, material, environmental, archaeological, or other site conditions that differ materially from those indicated in the Contract Documents, he shall immediately notify the Employer's Agent in writing.

The Contractor shall take all reasonable measures to preserve the affected area pending inspection and instruction by the Employer's Agent.

No work affecting such conditions shall proceed without written approval.

PSDAM 2.11 RECORDS AND DOCUMENTATION

The Contractor shall maintain comprehensive records of all investigations, inspections, test results, geological observations, borrow area evaluations, foundation inspections, groundwater observations, and verification activities undertaken during construction.

These records shall form part of the Quality Assurance Documentation and As-Built Records for the Works.

PSDAM 2.12 MEASUREMENT AND PAYMENT

The costs associated with reviewing available information, verifying site conditions, facilitating inspections, maintaining records, reporting differing site conditions, and providing access for investigations shall be deemed to be included in the Contractor's tendered rates and prices unless specifically provided for elsewhere in the Bill of Quantities.

Separate payment will only be made for investigations specifically instructed by the Employer's Agent and identified as payable items in the Bill of Quantities.

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PSDAM 3 CLEARING AND GRUBBING

PSDAM 3.1 SCOPE

This specification covers the clearing, grubbing, stripping, removal, disposal and stockpiling of vegetation, topsoil, organic material, debris, obstructions and unsuitable materials within the footprint of the Off-Channel Storage Dam and all associated works.

The Works shall include, but not be limited to:

- (a) Dam embankment footprint;
- (b) Cut-off trench area;
- (c) Spillway area;
- (d) Intake tower area;
- (e) Outlet works;
- (f) Access roads;
- (g) Borrow areas;
- (h) Construction camp areas;
- (i) Stockpile areas;
- (j) Pipeline servitudes;
- (k) Temporary works areas; and
- (l) Any other areas required for the execution of the Works.

PSDAM 3.2 EXTENT OF CLEARING

The limits of clearing shall be as shown on the Drawings or as directed by the Employer's Agent.

The Contractor shall clearly demarcate the limits of clearing before commencing any clearing operations.

No vegetation shall be removed outside the approved clearing limits.

Particular care shall be taken to protect vegetation and environmentally sensitive areas that are to remain undisturbed.

PSDAM 3.3 REMOVAL OF VEGETATION

All trees, bushes, shrubs, grass, reeds, roots, stumps, fallen timber and other vegetation occurring within the approved construction areas shall be removed.

Vegetation shall be removed in a manner that minimises disturbance to areas outside the approved limits.

The Contractor shall comply with all requirements of the Environmental Authorisation and Environmental Management Programme (EMPr).

No burning of vegetation shall be permitted unless specifically authorised by the relevant authorities and approved by the Employer's Agent.

PSDAM 3.4 GRUBBING

All stumps, roots, root systems, buried timber, organic matter and other deleterious materials shall be grubbed out and removed from the areas to be occupied by permanent works.

Within the dam embankment footprint, cut-off trench, spillway foundations, intake tower foundations, outlet works foundations and other structural foundations, all roots and organic material shall be completely removed.

Root holes and cavities created by grubbing operations shall be backfilled with approved material and compacted to the specified density.

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PSDAM 3.5 STRIPPING OF TOPSOIL

Topsoil shall be stripped from all areas designated by the Employer's Agent.

Unless otherwise directed, topsoil shall be removed to the full depth of organic or biologically active material.

The depth of stripping shall be determined by site conditions and approved by the Employer's Agent.

Particular attention shall be given to the removal of topsoil from:

- (a) Dam embankment footprint;
- (b) Cut-off trench alignment;
- (c) Spillway footprint;
- (d) Borrow areas;
- (e) Access roads; and
- (f) Permanent structures.

PSDAM 3.6 STOCKPILING OF TOPSOIL

Suitable topsoil intended for rehabilitation shall be stockpiled separately from other excavated materials.

Topsoil stockpiles shall:

- (a) Be located in approved areas;
- (b) Be protected against erosion;
- (c) Be protected against contamination;
- (d) Be clearly identified; and
- (e) Not interfere with construction activities.

Topsoil stockpiles shall be maintained in a condition suitable for later use during rehabilitation and landscaping operations.

PSDAM 3.7 DISPOSAL OF UNSUITABLE MATERIAL

All vegetation, roots, stumps, organic material, contaminated material, debris and other unsuitable materials shall be removed from the Site and disposed of at approved disposal facilities.

Disposal shall comply with all applicable environmental requirements.

No unsuitable material shall be incorporated into the permanent works.

PSDAM 3.8 PROTECTION OF EXISTING FEATURES

The Contractor shall protect all property boundaries, survey beacons, benchmarks, services, fences, roads, watercourses, structures and vegetation designated to remain.

Any damage caused by the Contractor shall be repaired at the Contractor's expense.

PSDAM 3.9 ENVIRONMENTAL REQUIREMENTS

Clearing operations shall be undertaken in accordance with the approved Environmental Management Programme (EMPr).

The Contractor shall implement measures to control:

- (a) Soil erosion;
- (b) Dust generation;

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- (c) Sedimentation;
- (d) Spread of invasive vegetation;
- (e) Damage to adjacent vegetation; and
- (f) Pollution of watercourses.

Clearing shall be limited to the minimum area necessary to execute the Works.

PSDAM 3.10 INSPECTION AND APPROVAL

The Employer's Agent shall inspect all cleared and grubbed areas before further construction activities commence.

No foundation excavation, cut-off trench excavation, embankment construction or concrete works shall proceed until the cleared areas have been approved by the Employer's Agent.

The Contractor shall provide all access, labour and assistance required for inspections.

PSDAM 3.11 MEASUREMENT AND PAYMENT

Clearing and grubbing shall be measured in hectares (ha) or square metres (m²), as specified in the Bill of Quantities.

The rates tendered shall include full compensation for:

- (a) Clearing vegetation;
- (b) Grubbing roots and stumps;
- (c) Stripping topsoil;
- (d) Stockpiling topsoil;
- (e) Disposal of unsuitable material;
- (f) Protection of existing features;
- (g) Environmental protection measures; and
- (h) All labour, plant, equipment and incidentals necessary to complete the Works.

No separate payment shall be made for work required to comply with environmental obligations or for repeated clearing resulting from the Contractor's operations.

PSDAM 4 FOUNDATION EXCAVATION

PSDAM 4.1 SCOPE

This specification covers all excavation, preparation, inspection, treatment and approval of foundations for the Off-Channel Storage Dam (OCSD), including the embankment foundation, cut-off trench, spillway, intake tower, outlet works, pump station foundations, valve chambers and all associated permanent structures.

The work shall include clearing of foundation areas, removal of unsuitable material, excavation to approved founding levels, foundation cleaning, dewatering, protection of exposed foundations, foundation mapping, inspection and all ancillary work necessary to provide suitable foundations for the permanent works.

PSDAM 4.2 GENERAL REQUIREMENTS

The Contractor shall excavate all foundation areas to the lines, grades, dimensions and levels shown on the Drawings or as directed by the Employer's Agent.

Foundation excavation shall continue until competent material suitable for the intended purpose has been exposed and approved by the Employer's Agent.

The Contractor shall not disturb, loosen, fracture, soften, contaminate or otherwise damage any material below the required founding level.

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The Contractor shall immediately notify the Employer's Agent upon exposure of foundation conditions that differ from those anticipated in the design reports or Contract Documents.

PSDAM 4.3 FOUNDATION STRIPPING

All vegetation, topsoil, organic material, roots, unsuitable soils, loose material, debris and deleterious matter shall be removed from the dam footprint and all foundation areas.

Stripping shall extend beyond the toes of the embankment and the limits of permanent structures as directed by the Employer's Agent.

No embankment fill or structural concrete shall be placed on topsoil, organic material or unsuitable foundation material.

PSDAM 4.4 CLASSIFICATION OF EXCAVATION

Excavation shall be classified as:

- (a) Common excavation;
- (b) Soft excavation;
- (c) Intermediate excavation;
- (d) Hard excavation;
- (e) Rock excavation.

Classification shall be determined by the Employer's Agent based on the nature of the material encountered.

No distinction shall be made between wet and dry excavation.

PSDAM 4.5 EXCAVATION OF EMBANKMENT FOUNDATIONS

The entire embankment footprint shall be excavated and prepared to expose competent founding material.

All soft pockets, collapsible material, organic material, highly weathered material, loose zones, seepage-prone areas and any other unsuitable material shall be removed.

Where directed by the Employer's Agent, foundation benches shall be excavated into sloping ground to provide adequate bonding between the embankment and natural ground.

Benches shall be cut into competent material and shall be maintained free of loose material and standing water.

PSDAM 4.6 EXCAVATION FOR STRUCTURAL FOUNDATIONS

Excavation for intake towers, outlet structures, spillways, valve chambers, pump stations and other concrete structures shall be carried out to approved founding levels.

Excavation shall continue until sound and competent material is exposed.

Any disturbed, loosened or unsuitable material below founding level shall be removed and replaced with approved concrete, compacted fill or other approved material

PSDAM 4.7 ROCK EXCAVATION

Where rock excavation is required, excavation methods shall minimise disturbance to the remaining rock mass.

Blasting shall be carefully controlled to avoid overbreak, excessive fracturing, loosening of the foundation or damage to adjacent structures.

The Contractor shall submit a detailed blasting method statement for approval before commencing blasting operations.

All blast-damaged rock identified by the Employer's Agent shall be removed.

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PSDAM 4.8 OVER-EXCAVATION

Over-excavation beyond the specified lines and levels shall be avoided.

Any over-excavation resulting from the Contractor's operations shall be made good using approved materials and methods at the Contractor's cost.

No additional payment shall be made for excavation beyond the specified limits unless specifically instructed by the Employer's Agent.

PSDAM 4.9 FOUNDATION DEWATERING

The Contractor shall provide all pumps, drains, diversion channels, sumps, well points and other facilities required to maintain dry and stable excavation conditions.

Foundation excavations shall be kept free of standing water, mud, seepage accumulations and erosion.

Dewatering operations shall not adversely affect adjacent structures, slopes, foundations or environmental resources.

No fill or concrete shall be placed on flooded, saturated or unstable foundations.

PSDAM 4.10 FOUNDATION CLEANING

Upon completion of excavation, all foundation surfaces shall be thoroughly cleaned.

Cleaning shall include removal of:

- (a) Loose material;
- (b) Mud;
- (c) Standing water;
- (d) Organic matter;
- (e) Weathered material;
- (f) Debris;
- (g) Oil, grease and contaminants; and
- (h) Any other deleterious material.

Rock foundations shall be cleaned by mechanical means, compressed air, water jetting or other approved methods.

Immediately before placement of fill or concrete, the foundation shall be in a clean and approved condition.

PSDAM 4.11 FOUNDATION MAPPING AND INSPECTION

Following excavation and cleaning, foundation conditions shall be inspected by the Employer's Agent.

Where required, exposed rock surfaces shall be geologically mapped by a suitably qualified Engineering Geologist.

The mapping shall record:

- (a) Rock type;
- (b) Degree of weathering;
- (c) Joints and discontinuities;
- (d) Faults and shear zones;
- (e) Groundwater seepage;
- (f) Cavities and voids; and

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(g) Any other features affecting dam safety or foundation performance.

No foundation shall be covered until inspected and approved.

PSDAM 4.12 PROOF ROLLING

Where directed by the Employer's Agent, exposed foundation surfaces shall be proof rolled using approved equipment to identify soft zones, unstable areas or inadequate bearing conditions.

Any areas failing proof rolling requirements shall be excavated and treated as directed by the Employer's Agent.

PSDAM 4.13 PROTECTION OF EXPOSED FOUNDATIONS

Approved foundation surfaces shall be protected against:

- (a) Erosion;
- (b) Drying and cracking;
- (c) Saturation;
- (d) Weathering;
- (e) Construction traffic;
- (f) Contamination; and
- (g) Flooding.

Should foundation conditions deteriorate after approval, the Contractor shall re-excavate, re-clean and restore the foundation to an acceptable condition at his own expense.

PSDAM 4.14 FOUNDATION ACCEPTANCE

No embankment fill, concrete, filter material, drainage material or permanent works shall be placed until written approval of the foundation has been obtained from the Employer's Agent.

Approval of a foundation shall not relieve the Contractor of responsibility for the adequacy of the completed Works.

PSDAM 4.15 RECORDS

The Contractor shall maintain detailed records of all excavation activities, including:

- (a) Excavation levels;
- (b) Foundation profiles;
- (c) Geological observations;
- (d) Groundwater conditions;
- (e) Foundation treatment requirements;
- (f) Test results;
- (g) Survey records; and
- (h) Photographic records.

The records shall form part of the permanent quality assurance documentation and as-built records.

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PSDAM 4.16 MEASUREMENT AND PAYMENT

Measurement for foundation excavation shall be based on the authorised dimensions shown on the Drawings or instructed by the Employer's Agent.

The tendered rates shall include full compensation for excavation, trimming, cleaning, dewatering, foundation preparation, temporary support, protection of exposed foundations, disposal of unsuitable material, inspection assistance and all incidental work necessary to complete the foundation excavation.

Separate payment shall only be made for items specifically measured and listed in the Bill of Quantities.

PSDAM 5 FOUNDATION TREATMENT

PSDAM 5.1 GENERAL REQUIREMENTS

The foundation treatment works shall comprise all activities necessary to prepare and improve the dam foundation to achieve the stability, strength and seepage control requirements of the Off-Channel Storage Dam (OCS).

The Contractor shall undertake foundation treatment in accordance with the approved Drawings, the Geotechnical Investigation Report, the Dam Safety Design Report and the requirements of the Employer's Agent.

The foundation treatment philosophy adopted for the OCS is based on the geotechnical conditions encountered during the investigations, including the presence of residual soils, loose alluvial deposits, perched groundwater, weathered rock profiles, localised shear zones and contacts between diabase and granite formations.

PSDAM 5.2 FOUNDATION PREPARATION

Following completion of foundation excavation, all exposed foundation surfaces shall be thoroughly cleaned and inspected.

The Contractor shall remove all loose material, weathered rock, organic matter, debris, mud, standing water and unsuitable material from the foundation surface.

Rock surfaces shall be cleaned by mechanical means, compressed air and pressure washing to expose competent founding material and open rock discontinuities.

Particular attention shall be paid to the cleaning of fractures, joints and weathered seams prior to commencement of any foundation treatment works.

PSDAM 5.3 REMOVAL OF UNSUITABLE MATERIAL

All unsuitable material encountered within the foundation area shall be removed.

Unsuitable materials may include:

- (a) Organic material;
- (b) Loose material;
- (c) Soft soils;
- (d) Highly weathered material;
- (e) Collapsible soils;
- (f) Dispersive soils;
- (g) Fractured rock;
- (h) Fault gouge;

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- (i) Clay seams;
- (j) Voids and cavities; and
- (k) Any other material deemed unsuitable by the Employer's Agent.

Excavation shall continue until competent material acceptable to the Employer's Agent is exposed.

PSDAM 5.4 DENTAL CONCRETE

Irregularities, depressions, cavities, weathered pockets and local overbreak occurring within the exposed bedrock surface shall be treated using dental concrete.

Dental concrete shall be used to create a uniform and competent foundation surface and to eliminate local seepage paths beneath the embankment core and cut-off trench.

The extent of dental concrete treatment shall be determined by the Employer's Agent following foundation mapping and inspection.

PSDAM 5.5 TREATMENT OF SHEAR ZONES

Where shear zones, fractured zones or zones of excessive permeability are encountered during excavation, additional treatment shall be undertaken.

The treatment may include:

- Additional excavation and replacement;
- Dental concrete;
- Consolidation grouting;
- Secondary or tertiary grout holes;
- Other measures directed by the Employer's Agent.

All identified shear zones shall be mapped and recorded before treatment commences.

PSDAM 5.7 FOUNDATION GROUTING

Foundation grouting shall be undertaken beneath the embankment core and cut-off trench to reduce seepage through fractured rock and geological contacts.

The grout curtain shall consist of cement-bentonite grout injected into primary, secondary and tertiary grout holes drilled into the underlying bedrock.

Grouting shall extend into moderately weathered to fresh bedrock as shown on the Drawings and as directed by the Employer's Agent.

The final depth and extent of grouting shall be determined from actual geological conditions encountered during drilling

PSDAM 5.8 GROUTING ACCEPTANCE CRITERIA

Grouting shall continue until the specified refusal criteria are achieved.

Unless otherwise directed by the Employer's Agent, the target permeability following treatment shall be less than 3 Lugeons.

The Contractor shall maintain detailed records of drilling, water pressure testing, grout takes, grout pressures and grout consumption for each hole.

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PSDAM 5.9 GROUNDWATER CONTROL

Special attention shall be given to perched groundwater conditions identified during the geotechnical investigations.

The Contractor shall provide all necessary pumping, drainage, diversion and dewatering measures to maintain dry and stable foundation conditions throughout construction.

No fill shall be placed on saturated or unstable foundation surfaces.

PSDAM 5.10 INSPECTION AND APPROVAL

All foundation treatment works shall be inspected by the Employer's Agent before the placement of embankment fill, filter materials, drainage materials or structural concrete.

The Contractor shall provide safe access, labour, equipment and all necessary assistance required for inspection.

No permanent works shall proceed until written approval has been obtained.

PSDAM 5.11 QUALITY CONTROL AND TESTING

The Contractor shall implement a quality control programme for all foundation treatment activities.

The programme shall include:

- (a) Inspection records;
- (b) Foundation mapping records;
- (c) Grouting records;
- (d) Material test results;
- (e) Concrete test results;
- (f) Survey records; and
- (g) Photographic records.

All records shall be submitted to the Employer's Agent and shall form part of the permanent project records.

PSDAM 5.12 RECORDS

Comprehensive records shall be maintained of:

- (a) Foundation conditions encountered;
- (b) Defects identified;
- (c) Areas treated;
- (d) Volumes of excavation;
- (e) Dental concrete placement;
- (f) Grouting activities;
- (g) Drainage installations; and
- (h) All inspections and approvals.

These records shall be incorporated into the Quality Assurance Documentation and As-Built Records.

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PSDAM 5.13 MEASUREMENT AND PAYMENT

Measurement for foundation treatment shall be based on the items provided in the Bill of Quantities.

The rates tendered shall include full compensation for labour, materials, plant, equipment, cleaning, preparation, excavation, disposal, dewatering, inspection assistance, quality control, record keeping and all incidental work necessary to complete the foundation treatment works.

Only authorised quantities measured and approved by the Employer's Agent shall be eligible for payment.

PSDAM 6 CUT-OFF TRENCH

PSDAM 6.1 SCOPE

This specification covers the excavation, preparation, treatment, backfilling, compaction, inspection and approval of the cut-off trench forming part of the seepage control system for the Off-Channel Storage Dam (OCSD).

The cut-off trench shall be constructed beneath the impervious core of the embankment and shall provide a continuous seepage barrier between the embankment and competent foundation material.

The Works shall include excavation, dewatering, foundation preparation, removal of unsuitable material, treatment of defects, backfilling with approved impervious material, compaction, quality control testing and all ancillary works necessary for the completion of the cut-off trench.

PSDAM 6.2 GENERAL

A continuous seepage cut-off system shall be constructed beneath the embankment core consisting of:

- A compacted clay key trench;
- A triple-line grout curtain;
- Bentonite water stop sealing system;
- Associated foundation treatment measures.

The seepage barrier system shall provide continuity between the impervious core and competent bedrock and shall minimise seepage beneath the dam.

PSDAM 6.3 EXCAVATION OF KEY TRENCH

The key trench shall be excavated along the centreline of the embankment and beneath the impervious core to the dimensions shown on the Drawings.

Excavation shall continue through all alluvial deposits, loose sands, residual soils and weathered material until competent bedrock is encountered.

The trench shall be extended where necessary to intercept permeable zones, weathered contacts and other potential seepage paths.

PSDAM 6.4 FOUNDATION CLEANING

Upon completion of excavation, the exposed bedrock surface shall be cleaned by:

- Removal of loose material;
- Pressure washing;
- Air cleaning of joints and fractures;
- Removal of all unsuitable material.

No backfilling shall commence until the foundation has been inspected and approved.

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PSDAM 6.4 DENTAL CONCRETE TREATMENT

Rock depressions, cavities, weathered pockets and irregular bedrock surfaces shall be treated using dental concrete to provide a sound interface between the bedrock and the impervious core system.

PSDAM 6.5 GROUT CURTAIN

A triple-line grout curtain shall be installed beneath the key trench and embankment core.

The grout curtain shall consist of:

- Primary grout holes;
- Secondary grout holes;
- Tertiary grout holes where required.

The initial primary hole spacing shall generally be between 2 m and 3 m.

Additional holes shall be drilled where grout takes, permeability testing or geological conditions indicate the need for further treatment.

PSDAM 6.6 GROUT MATERIAL

Grouting shall be undertaken using cement-bentonite grout designed to penetrate fractures, joints and seepage paths within the foundation rock.

The grout mix design shall be submitted to the Employer's Agent for approval prior to commencement of grouting operations.

PSDAM 6.7 TREATMENT OF GEOLOGICAL CONTACTS

Particular attention shall be paid to:

- Diabase-granite contacts;
- Fractured rock zones;
- Shear zones;
- Weathered seams;
- High permeability zones.

Where necessary, split-spacing secondary and tertiary grout holes shall be installed to achieve the specified seepage performance.

PSDAM 6.8 BENTONITE WATERSTOP

A hydrophilic bentonite waterstop shall be installed at the interface between the compacted clay core and treated foundation.

The waterstop shall provide a continuous seal along the full length of the key trench.

Installation shall be in strict accordance with the manufacturer's recommendations.

PSDAM 6.9 KEY TRENCH BACKFILL

The key trench shall be backfilled using approved compacted residual diabase clay obtained from approved borrow sources.

The material shall be placed in layers not exceeding 200 mm loose thickness and compacted to not less than 98% Modified AASHTO Maximum Dry Density.

The completed trench shall achieve a permeability not exceeding 1×10^{-7} cm/s.

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PSDAM 6.10 QUALITY CONTROL

The Contractor shall undertake testing and monitoring of all seepage control works including:

- Permeability testing;
- Water pressure testing;
- Grout records;
- Compaction testing;
- Moisture content testing;
- Survey verification.

All records shall form part of the permanent dam safety quality documentation.

PSDAM 6.11 MEASUREMENT AND PAYMENT

Measurement for cut-off trench excavation, foundation treatment and backfilling shall be in accordance with the Bill of Quantities.

The tendered rates shall include full compensation for setting out, excavation, dewatering, cleaning, foundation preparation, treatment of defects, supply of impervious material, placement, compaction, testing, quality control, survey work, record keeping and all incidental work necessary to complete the cut-off trench.

Only authorised quantities measured and approved by the Employer's Agent shall be eligible for payment.

PSDAM 7 BORROW AREAS AND QUARRY MATERIALS

PSDAM 7.1 GENERAL

The Contractor shall identify, investigate, develop, operate, maintain and rehabilitate all borrow areas, quarry sites and material sources required for the construction of the Off-Channel Storage Dam (OCSD), weir, spillway, access roads, pipelines and associated infrastructure.

All borrow areas and quarry sites shall be approved by the Employer's Agent prior to commencement of excavation activities. The Contractor shall be responsible for obtaining all permits, licences, environmental approvals and landowner permissions required for the development and operation of borrow areas.

The Contractor shall undertake all necessary investigations, including test pits, trial excavations, laboratory testing and material assessments to confirm the suitability of materials for their intended purpose.

No material shall be incorporated into the Works until compliance with the specified engineering requirements has been demonstrated and approved.

PSDAM 7.2 MATERIAL CLASSIFICATION AND INTENDED USE

Materials obtained from borrow areas shall be classified and selectively excavated according to their engineering properties and intended use within the Works.

The Contractor shall ensure that materials intended for impervious zones, transition zones, drainage zones, structural fill and general fill are separately identified, stockpiled and protected from contamination.

Materials shall generally be classified into the following categories:

(a) Impervious Core Material

Impervious core material shall consist primarily of residual diabase clayey soils identified during the geotechnical investigations.

The material shall possess low permeability and suitable plasticity characteristics for use in the central clay core and cut-off trench backfill.

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(b) Transition Zone Material

Transition materials shall consist of selected residual granite and suitable alluvial deposits capable of forming the semi-pervious transition zones between the clay core and rockfill shell.

(c) Rockfill Material

Rockfill shall consist of fresh to slightly weathered granite, pegmatite or diabase obtained from approved quarry sources.

Rockfill material shall be used for the embankment shell zones, riprap protection and other structural applications requiring durable rock.

(d) Drainage and Filter Materials

Drainage and filter materials shall consist of clean, uniformly graded sands and gravels obtained from approved alluvial deposits.

These materials shall be used for chimney drains, blanket drains, toe drains and filter zones.

(e) General Fill Material

General fill shall consist of suitable granular material free from organic matter, roots, topsoil and deleterious substances.

General fill shall comply with the requirements specified for embankment and backfilling works.

PSDAM 7.3 BORROW AREA INVESTIGATIONS

Prior to commencing borrow area development, the Contractor shall undertake detailed investigations to confirm:

- Extent of the borrow area;
- Depth of suitable material;
- Material variability;
- Groundwater conditions;
- Material quantities;
- Material quality;
- Accessibility of the borrow area;
- Environmental constraints.

The Contractor shall submit a Borrow Area Development Plan for approval.

The plan shall include:

- Location plans;
- Test pit records;
- Geological information;
- Laboratory test results;
- Estimated material quantities;
- Production methods;
- Environmental protection measures;

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- Rehabilitation proposals.

PSDAM 7.4 GENERAL FILL MATERIAL REQUIREMENTS

General fill material shall consist of well-graded granular material suitable for embankment construction and backfilling operations.

The material shall comply with the following requirements:

Property	Requirement
Plasticity Index (PI)	Less than 12
Maximum Particle Size	75 mm
Organic Content	Nil
Deleterious Material	Nil

The Contractor shall ensure that the material remains free from contamination throughout excavation, transportation, stockpiling and placement.

PSDAM 7.5 STRUCTURAL FILL MATERIAL REQUIREMENTS

Structural fill shall be used in areas requiring engineered backfill, foundation replacement, structure backfill and replacement of unsuitable materials.

Structural fill shall consist of selected granular material capable of achieving the specified density and bearing capacity requirements.

The material shall comply with:

Property	Requirement
Compaction	Minimum 95% Modified AASHTO
CBR	Minimum 15%
Organic Content	Nil
Maximum Particle Size	75 mm

The Employer's Agent may require additional testing where structural fill is used beneath structures, roadways or foundation replacement zones.

PSDAM 7.6 DRAINAGE AND FILTER MATERIAL REQUIREMENTS

Drainage and filter materials shall consist of clean, durable and uniformly graded sands and gravels.

The materials shall be free from clay, silt, organic matter and deleterious substances.

The Contractor shall demonstrate through laboratory testing that all drainage and filter materials satisfy the approved filter compatibility criteria relative to adjacent embankment zones.

Drainage materials shall possess adequate permeability to safely convey seepage and prevent the development of excessive pore water pressures within the embankment.

PSDAM 7.7 QUARRY DEVELOPMENT AND ROCKFILL SOURCES

The Contractor shall establish and operate approved quarry areas for the production of rockfill, riprap and crushed rock materials.

The principal rock types encountered within the project area comprise granite, pegmatite and diabase.

These materials have been identified through geotechnical investigations as suitable sources for rockfill and riprap construction.

Rock excavation shall be undertaken using controlled drilling and blasting methods designed to:

- Produce durable rockfill material;

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- Minimise excessive fines;
- Prevent overbreak;
- Protect adjacent structures and slopes;
- Maintain quarry stability.

Fresh to slightly weathered rock shall be preferentially selected for rockfill and riprap production.

PSDAM 7.8 EXCAVATION OF UNSUITABLE MATERIALS

All unsuitable materials encountered within foundation areas, borrow areas and embankment footprints shall be removed and disposed of in approved spoil areas.

Unsuitable materials include:

- Topsoil;
- Organic soils;
- Colluvium;
- Residual soils unsuitable for their intended purpose;
- Alluvium within foundation zones;
- Soft, loose or compressible materials;
- Uncontrolled fill;
- Weathered or fractured materials deemed unsuitable by the Employer's Agent.

Particular attention shall be given to paleo-channel deposits encountered beneath the dam and weir footprints.

PSDAM 7.9 PALEO-CHANNEL EXCAVATION AND REPLACEMENT

The paleo-channel zone represents a critical geotechnical risk due to the presence of unconsolidated alluvial materials extending to depths of approximately 6.4 m.

All alluvial deposits, loose sands, gravels and other unsuitable materials encountered within paleo-channel zones shall be completely excavated to competent founding rock.

Excavation shall continue until slightly weathered to fresh rock meeting the specified foundation requirements has been exposed.

Following approval of the excavation, the excavated zone shall be backfilled using approved structural fill, engineered embankment material or concrete as indicated on the Drawings and directed by the Employer's Agent.

Compaction and testing requirements shall comply with the relevant project specifications.

PSDAM 7.10 STOCKPILING AND MATERIAL MANAGEMENT

The Contractor shall establish separate stockpile areas for:

- Clay core materials;
- Transition materials;
- Drainage materials;
- Structural fill;

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- Rockfill;
- Riprap;
- Unsuitable materials.

Stockpiles shall be clearly identified and protected from contamination, erosion, excessive drying or saturation.

Mixing of different material classes shall not be permitted.

PSDAM 7.11 ENVIRONMENTAL MANAGEMENT AND REHABILITATION

Borrow areas and quarry sites shall be operated in accordance with the approved Environmental Management Programme (EMPr).

The Contractor shall implement measures to control:

- Dust;
- Erosion;
- Sedimentation;
- Noise;
- Surface water contamination;
- Vegetation disturbance.

Upon completion of material extraction, all borrow areas shall be rehabilitated to the satisfaction of the Employer's Agent and relevant authorities.

Rehabilitation shall include shaping, topsoiling, drainage control, revegetation and erosion protection measures.

PSDAM 7.12 QUALITY CONTROL

The Contractor shall undertake continuous quality control testing of all borrow materials.

Testing shall include, where applicable:

- Particle size distribution;
- Atterberg limits;
- Moisture-density relationships;
- CBR testing;
- Permeability testing;
- Compaction testing;
- Rock quality assessment;
- Durability testing.

Materials failing to comply with the specified requirements shall be removed from the Works and replaced at the Contractor's expense.

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PSDAM 8: DAM EMBANKMENT EARTHWORKS

PSDAM 8.1 SCOPE

This specification covers all earthworks associated with the construction of the Off-Channel Storage Dam embankment, including excavation, processing, hauling, placement, moisture conditioning, compaction, testing and quality control of all embankment materials.

The Works include:

- Foundation preparation.
- Core trench excavation and backfilling.
- Construction of impervious core zones.
- Construction of shell zones.
- Construction of filter and transition zones.
- Construction of drainage blankets and toe drains.
- Construction of upstream and downstream embankment zones.
- Moisture conditioning and compaction.
- Quality control testing.
- Construction records and as-built documentation.

All work shall comply with the Drawings, Specifications, Geotechnical Design Report and the requirements of the Employer's Agent.

PSDAM 8.2 MATERIAL ZONING

The embankment shall be constructed using the zoning arrangement indicated on the Drawings.

The embankment shall generally comprise:

1. Zone 1 – Impermeable Central Core
2. Zone 2 – Transition Zones
3. Zone 3 – Rockfill Shell Zones
4. Zone 4 – Filter and Drainage Zones
5. Zone 5 – Drainage Blanket and Toe Drain System
6. Zone 6 – Cut-Off Trench and Foundation Seepage Control System

Only materials approved by the Employer's Agent and Design Engineer shall be incorporated into the respective zones.

The zoning arrangement and limits shall be as shown on the Drawings.

Materials for each zone shall be excavated, stockpiled, transported and placed separately. No mixing of materials from different zones shall be permitted.

The Contractor shall maintain separate stockpiles for:

- Core material
- Transition material
- Filter material
- Drainage material
- Rockfill material

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PSDAM 8.3 FOUNDATION PREPARATION

Prior to placement of embankment material the Contractor shall:

- Clear and grub all foundation areas.
- Strip topsoil and unsuitable material.
- Excavate all soft, loose or unsuitable material.
- Prepare the foundation to the lines and levels shown on the Drawings.
- Construct the cut-off trench where required.
- Maintain foundations free of standing water.

No fill shall be placed until the prepared foundation has been inspected and approved by the Employer's Agent.

PSDAM 8.4 FOUNDATION CUT-OFF SYSTEM

The seepage cut-off system shall comprise excavation to competent bedrock and construction of a grout curtain as shown on the Drawings.

The Contractor shall:

- Excavate the cut-off trench to the required depth.
- Remove all loose and weathered material.
- Prepare bedrock surfaces.
- Undertake curtain grouting where specified.
- Maintain detailed grouting records.

The extent of grouting shall be determined by the Design Engineer based on drilling results and grout take

PSDAM 8.5 CORE MATERIAL REQUIREMENTS

Core material shall be obtained primarily from approved residual diabase borrow areas identified during the geotechnical investigation.

The material shall generally comprise clayey sand, sandy clay and clay classified as:

- CL
- CH
- SC

The material shall comply with:

- 1) Plasticity Index (PI): 15–25 preferred
- 2) Minimum PI: 10
- 3) Maximum PI: 35
- 4) Passing 0.075 mm sieve: 20–50%
- 5) Maximum particle size after processing: 75 mm

The material shall be non-dispersive and free from organic matter, roots, debris and deleterious substances. Material with excessive gravel, cobbles or rock fragments shall be screened or processed before placement.

The Contractor shall demonstrate compliance through laboratory testing before approval for placement.

Core material shall be placed only after approval of foundation preparation.

PSDAM 8.6 TRANSITION ZONE MATERIAL

Transition material shall be obtained from approved residual granite and selected alluvial deposits.

The material shall generally comprise:

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- SC
- SM-SC
- SW-SM

Material Requirements:

- 1) Plasticity Index: 0 – 12
- 2) Preferred PI: 4 – 10
- 3) Passing 0.075 mm sieve: 5 – 15%
- 4) Maximum particle size: 150 mm

The transition zone shall prevent migration of core fines into adjacent zones and shall be placed continuously with the core.

PSDAM 8.7 ROCKFILL SHELL MATERIAL

Rockfill shall be obtained from approved quarry sources comprising competent granite and diabase.

Material Requirements:

- 1) Plasticity Index: NP to 3
- 2) Passing 0.075 mm sieve: less than 5%
- 3) Maximum particle size: 1000 mm
- 4) Nominal placement size: 600 mm

The rockfill shall consist of durable fresh to slightly weathered rock and shall be free from clay pockets, weathered material and deleterious substances.

Controlled blasting techniques shall be employed to achieve suitable rockfill grading.

PSDAM 8.8 FILTER MATERIAL

Filter material shall be obtained from approved alluvial deposits and shall consist of clean free-draining sand and fine gravel.

Material Requirements:

USCS Classification:

- SP
- SW
- SP-SM

- 1) Plasticity Index: NP to 6
- 2) Passing 0.075 mm sieve: less than 5%
- 3) Maximum particle size: 37.5 mm

The filter material shall be compatible with the adjoining core and transition materials and shall prevent internal erosion and piping.

PSDAM 8.9 DRAINAGE BLANKET AND TOE DRAIN MATERIAL

Drainage blanket and toe drain material shall comprise clean coarse sand and fine gravel obtained from approved alluvial sources.

Material Requirements:

USCS Classification:

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- SP
 - SW
 - SP-SM
- 1) Plasticity Index: NP to 6
 - 2) Passing 0.075 mm sieve: less than 5%
 - 3) Permeability: greater than 1×10^{-3} m/s
 - 4) Maximum particle size: 37.5 mm

The drainage system shall remain free draining throughout construction.

Contaminated drainage material shall be removed and replaced.

PSDAM 8.10 PLACEMENT OF EMBANKMENT MATERIAL

Material shall be placed in horizontal layers extending across the full width of the respective zone.

Segregation of material shall not be permitted.

The Contractor shall ensure proper bonding between successive layers.

No frozen, saturated or unsuitable material shall be placed within the embankment.

PSDAM 8.11 LAYER THICKNESS

Maximum compacted layer thickness shall be:

- 1) Core Material: 150 mm
- 2) Transition Material: 200 mm
- 3) Filter Material: 150 mm
- 4) Drainage Material: 200 mm
- 5) Rockfill Material: 500 mm

No subsequent layer shall be placed until the underlying layer has been tested and approved.

PSDAM 8.12 MOISTURE CONDITIONING

All materials requiring compaction shall be conditioned to the moisture content necessary to achieve the specified density.

Water shall be applied uniformly and mixed thoroughly into the material.

Material outside the approved moisture range shall not be compacted.

PSDAM 8.13 COMPACTION REQUIREMENTS

Minimum Compaction Requirements:

- a) Clay Core: 98% Modified AASHTO Density
- b) Transition Zones: 95% Modified AASHTO Density
- c) Filter Zones: 95% Modified AASHTO Density
- d) Drainage Zones: 95% Modified AASHTO Density

Rockfill Shells: Compacted by approved heavy vibratory rollers using the approved number of roller passes established during trial embankment construction.

PSDAM 8.14 TRIAL EMBANKMENT

Prior to bulk embankment construction the Contractor shall construct a trial embankment using the proposed materials, plant and compaction methods.

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The trial embankment shall establish:

- Layer thickness.
- Moisture content range.
- Number of roller passes.
- Achievable densities.
- Quality control procedures.

Bulk construction shall not commence until the Employer's Agent has approved the trial embankment.

PSDAM 8.15 QUALITY CONTROL TESTING

All testing shall be undertaken by a SANAS accredited laboratory approved by the Employer's Agent.

Minimum testing frequencies shall be:

Moisture Content:

1 test per 250 m³ placed.

Field Density:

1 test per 250 m³ placed.

Atterberg Limits:

1 test per 1000 m³.

Particle Size Distribution:

1 test per 1000 m³.

Filter Material Grading:

1 test per 250 m³.

Rockfill Gradation:

1 test per 1000 m³.

Additional testing shall be undertaken whenever material characteristics change.

PSDAM 8.16 INSTRUMENTATION AND MONITORING

The Contractor shall install all dam monitoring instrumentation shown on the Drawings including:

- Settlement plates.
- Survey monuments.
- Standpipe piezometers.
- Vibrating wire piezometers.
- Seepage monitoring installations.

Monitoring records shall be maintained throughout construction.

PSDAM 8.17 CONSTRUCTION RECORDS

The Contractor shall maintain detailed records including:

- Borrow source records.
- Material placement records.
- Daily quantities placed.
- Survey records.
- Moisture content records.
- Density test results.
- Grading test results.
- Instrumentation records.
- non-conformance reports.

Records shall be submitted monthly to the Employer's Agent.

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PSDAM 8.18 AS-BUILT SURVEYS

As-built surveys shall be undertaken during construction and upon completion.

The surveys shall include:

- Crest levels.
- Embankment slopes.
- Core limits.
- Drainage systems.
- Instrumentation locations.
- Toe drain alignments.

PSDAM 8.19 MEASUREMENT AND PAYMENT

No separate payment shall be made for:

- Moisture conditioning.
- Trial embankments.
- Quality control testing.
- Construction records.
- Material stockpiling.
- Processing of material.
- Foundation cleaning.
- Instrumentation installation assistance.

The costs thereof shall be deemed to be included in the tendered rates and prices for embankment construction unless specifically measured elsewhere in the Bill of Quantities.

PSDAM 9 – IMPERVIOUS CORE CONSTRUCTION

PSDAM 9.1 GENERAL

The impervious core shall constitute the primary seepage barrier of the Off-Channel Storage Dam (OCSD) and shall be constructed as a continuous central core extending from the cut-off trench to the crest of the embankment.

The core shall be founded on the approved seepage cut-off system comprising the key trench, foundation treatment measures and grout curtain described elsewhere in the Contract.

The design philosophy is based on the use of residual diabase clayey soils identified during the geotechnical investigations as being suitable for the construction of the impermeable core.

PSDAM 9.2 MATERIAL SOURCES

Impervious core material shall be obtained from approved borrow areas containing residual diabase and selected clayey colluvial soils identified during the geotechnical investigations.

The Contractor shall selectively excavate, process and stockpile suitable material to ensure compliance with the specified engineering requirements.

Material from other sources shall not be used without prior approval of the Employer's Agent.

PSDAM 9.3 MATERIAL REQUIREMENTS

The core material shall consist of clayey sand, sandy clay or clay classified generally as CL, CH or SC in accordance with the Unified Soil Classification System.

The material shall be substantially free from organic matter, roots, vegetation, topsoil, deleterious substances, oversized rock fragments and other unsuitable material.

The material shall comply with the following requirements:

Property	Requirement
Plasticity Index	15 – 25 Preferred
Minimum PI	10
Maximum PI	35

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Maximum Particle Size	75 mm
Fines Passing 0.075 mm Sieve	20 – 50%
Clay Fraction (<0.002 mm)	15 – 35%
Permeability	As specified by design

Residual diabase soils shall be regarded as the preferred source material.

PSDAM 9.4 PLACEMENT AND COMPACTION

Core material shall be placed in horizontal layers not exceeding 200 mm loose thickness.

The material shall be moisture conditioned and compacted to not less than 98% Modified AASHTO Maximum Dry Density.

Moisture content at compaction shall be maintained within the approved range established during trial embankment construction.

The Contractor shall ensure that construction of the core proceeds continuously and that the core remains integrated with the key trench and foundation treatment works.

PSDAM 9.5 QUALITY CONTROL

Testing shall include:

- a) Moisture content;
- b) Modified AASHTO density testing;
- c) Plasticity Index;
- d) Particle size distribution;
- e) Clay fraction determination;
- f) Permeability testing where required.

No material shall be incorporated into the Works unless compliance with the approved specification has been demonstrated.

PSDAM 10 – FILTER AND TRANSITION ZONES

PSDAM 10.1 GENERAL

The filter and transition zones shall provide a controlled transition between the impervious core and the outer rockfill shell and shall prevent migration of fines from the core while maintaining adequate drainage characteristics.

The zoning arrangement shall comply with the approved dam section and the requirements of the Dam Safety Design Report.

PSDAM 10.2 MATERIAL SOURCES

Transition material shall be obtained from approved sources of residual granite and selected alluvial deposits identified during the geotechnical investigations.

The material shall consist primarily of clayey sand, sandy clay and silty sand materials classified generally as SC, SM-SC, SW-SM or similar approved materials.

PSDAM 10.3 MATERIAL REQUIREMENTS

The transition zone shall comply with the following requirements:

Property	Requirement
Plasticity Index	0 – 12
Preferred PI	4 – 10
Maximum Particle Size	150 mm
Fines Passing 0.075 mm Sieve	5 – 15%

The material shall be free from organic matter and other deleterious substances.

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PSDAM 10.4 FILTER COMPATIBILITY

The Contractor shall ensure that all filter and transition materials satisfy the filter compatibility criteria specified in the design documentation.

The filter design shall satisfy:

$$D_{15}(\text{filter}) \leq 5 \times D_{85}(\text{base soil})$$

and

$$D_{15}(\text{filter}) \geq 4 \times D_{15}(\text{base soil})$$

The Contractor shall submit laboratory verification of filter compatibility prior to construction.

PSDAM 10.5 PLACEMENT

Transition materials shall be placed in horizontal layers not exceeding 250 mm loose thickness.

The material shall be placed in a manner that prevents segregation and contamination from adjacent zones.

Compaction shall achieve not less than 95% Modified AASHTO Maximum Dry Density unless otherwise specified.

PSDAM 10.6 QUALITY CONTROL

Testing shall include:

- a) Grading analyses;
- b) Plasticity Index;
- c) Density testing;
- d) Moisture content;
- e) Filter compatibility verification.

PSDAM 11 – ROCKFILL AND SHELL ZONES

PSDAM 11.1 GENERAL

The upstream and downstream shell zones shall provide structural stability to the embankment and shall consist of rockfill materials obtained from approved quarry sources.

The geotechnical investigations have identified competent granite and diabase bedrock on the right flank of the site suitable for the production of rockfill and riprap materials.

PSDAM 11.2 MATERIAL SOURCES

Rockfill shall be obtained from the approved quarry to be established on the right flank of the reservoir basin.

Material shall consist of fresh to slightly weathered granite and diabase produced by controlled drilling and blasting operations.

Controlled blasting and pre-splitting shall be employed where required to minimise excessive fracturing and degradation of rockfill material.

PSDAM 11.3 MATERIAL REQUIREMENTS

The rockfill shall comply with the following requirements:

Property	Requirement
Plasticity Index	NP to 3
Passing 0.075 mm Sieve	Less than 5%
Maximum Particle Size	600 – 1000 mm

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Material Type Durable granite or diabase

The material shall be free from clay lenses, weathered seams, organic matter and other unsuitable materials.

PSDAM 11.4 PLACEMENT

Rockfill shall be placed in layers not exceeding 500 mm loose thickness unless otherwise approved.

Oversized particles shall be distributed uniformly and segregation shall not be permitted.

The Contractor shall maintain close control over placement to ensure stability and uniform settlement of the embankment.

PSDAM 11.5 COMPACTION

Rockfill shall be compacted using approved heavy vibratory rollers.

Compaction procedures shall be established through trial embankment construction.

PSDAM 11.6 RIPRAP MATERIALS

Riprap for upstream slope protection shall be obtained from the same quarry source and shall consist of sound, durable granite or diabase meeting the grading requirements shown on the Drawings.

PSDAM 12 – INTERNAL DRAINAGE SYSTEM (CHIMNEY DRAIN, BLANKET DRAIN AND TOE DRAIN)

PSDAM 12.1 GENERAL

The internal drainage system shall consist of chimney drains, blanket drains, toe drains and associated filter materials designed to intercept and safely convey seepage from the embankment and foundation.

The drainage system shall be constructed concurrently with the embankment zones and shall remain continuous throughout the length of the dam.

PSDAM 12.2 MATERIAL SOURCES

Drainage materials shall be obtained from approved clean alluvial sand deposits identified within the central alluvial and stream channel deposits described in the geotechnical investigations.

The Contractor shall ensure that the material remains free from contamination throughout production, stockpiling and placement.

PSDAM 12.3 DRAINAGE MATERIAL REQUIREMENTS

Drainage material shall comply with the following requirements:

Property	Requirement
USCS Classification	SP, SW or SP-SM
Plasticity Index	NP to 6
Preferred PI	NP
Passing 0.075 mm Sieve	Less than 5%
Maximum Particle Size	37.5 mm
Permeability	Greater than 1×10^{-3} m/s
Organic Content	Nil

Clayey sands classified as SC shall not be used within drainage zones.

PSDAM 12.4 PARTICLE SIZE DISTRIBUTION

Drainage material shall generally comply with the following grading envelope:

Sieve Size	Percentage Passing
37.5 mm	100
19 mm	85 – 100
9.5 mm	60 – 90

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4.75 mm	35 – 70
2.0 mm	25 – 55
0.425 mm	10 – 30
0.075 mm	Less than 5

PSDAM 12.5 FILTER COMPATIBILITY

The Contractor shall verify through laboratory testing that all drainage materials satisfy the approved filter compatibility requirements relative to the core and transition zone materials.

The requirements of Terzaghi's filter criteria shall be satisfied throughout the drainage system.

PSDAM 12.6 PLACEMENT AND COMPACTION

Drainage materials shall be placed in layers not exceeding 250 mm loose thickness.

The material shall be compacted to a minimum of 95% Modified AASHTO Maximum Dry Density.

Contamination by core, transition or shell materials shall not be permitted.

Any contaminated material shall be removed and replaced at the Contractor's expense.

PSDAM 12.7 DRAINAGE CONTINUITY

The Contractor shall ensure continuity between the chimney drain, blanket drain and toe drain system and shall maintain all drainage pathways free of contamination and obstruction throughout construction.

No drainage element shall be covered until inspected and approved by the Employer's Agent.

PSDAM 13 – RIPRAP AND SLOPE PROTECTION

PSDAM 13.1 GENERAL

This specification covers the supply, production, transportation, placement and maintenance of riprap, bedding layers, filter layers and all slope protection works required for the Off-Channel Storage Dam (OCSD).

The purpose of the slope protection system is to protect the embankment against erosion resulting from wave action, rainfall runoff, reservoir drawdown, surface runoff and other environmental effects throughout the operational life of the dam.

The riprap protection system shall be constructed on the upstream embankment slope and at all other locations shown on the Drawings.

PSDAM 13.2 MATERIAL SOURCES

Riprap material shall be obtained from the approved quarry established on the right flank of the reservoir basin.

The material shall consist of fresh to slightly weathered granite and diabase rock identified during the geotechnical investigations as suitable for rockfill and riprap production.

The Contractor shall employ controlled blasting techniques to minimise excessive fracturing and degradation of the rock.

PSDAM 13.3 MATERIAL REQUIREMENTS

Riprap stone shall consist of sound, hard, durable and dense rock resistant to weathering, abrasion, disintegration and freeze-thaw deterioration.

The material shall be free from:

- Clay coatings;
- Organic matter;
- Laminated rock;

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- Weathered seams;
- Soft rock;
- Deleterious materials.

The grading of riprap shall comply with the Drawings and approved design requirements.

Oversized or undersized material outside the specified grading envelope shall be rejected.

PSDAM 13.4 BEDDING AND FILTER LAYERS

A bedding layer and/or filter layer shall be provided beneath all riprap protection unless otherwise shown on the Drawings.

Filter materials shall comply with PSDAM 10 and PSDAM 12 and shall satisfy the approved filter compatibility criteria. The filter system shall prevent migration of embankment materials while allowing free drainage. Proper filter compatibility is essential to prevent internal erosion and piping.

PSDAM 13.5 PREPARATION OF SLOPES

Prior to placement of riprap, the embankment slope shall:

- Be trimmed to the required lines and grades;
- Be compacted and approved;
- Be free of loose material;
- Be protected from erosion.

The Contractor shall not place riprap on unapproved surfaces.

PSDAM 13.6 PLACEMENT OF RIPRAP

Riprap shall be placed carefully to achieve a stable, interlocking layer of uniform thickness.

Segregation shall not be permitted.

Voids shall be minimised through proper placement and grading of the material.

Dumping of material from excessive heights that causes segregation shall not be permitted.

PSDAM 13.7 CREST AND DOWNSTREAM PROTECTION

The Contractor shall provide erosion protection to:

- Dam crest shoulders;
- Downstream slopes;
- Drainage outlets;
- Spillway tie-ins;
- Toe drain discharge areas;
- Any other erosion-prone areas identified by the Employer's Agent.

PSDAM 13.8 QUALITY CONTROL

Testing and inspections shall include:

- Quarry inspections;
- Material durability testing;
- Grading verification;

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- Layer thickness measurements;
- Survey verification;
- Visual inspection of placement quality.

PSDAM 13.9 MEASUREMENT AND PAYMENT

The tendered rates shall include full compensation for quarrying, blasting, processing, hauling, filter placement, riprap placement, trimming, quality control and all incidental works necessary to complete the slope protection system.

PSDAM 14 – SPILLWAY WORKS

PSDAM 14.1 GENERAL

This specification covers the construction of the spillway system, including excavation, foundation preparation, concrete works, energy dissipation structures, drainage systems, erosion protection works and all associated appurtenant structures.

The spillway shall safely convey the design flood and all operational flood releases without endangering the integrity of the dam or causing unacceptable erosion downstream. The spillway forms a critical safety component of the dam and shall be capable of preventing overtopping of the embankment.

PSDAM 14.2 SCOPE OF WORKS

The spillway works shall generally comprise:

- Spillway inlet structure;
- Spillway crest;
- Spillway channel;
- Spillway chute;
- Training walls;
- Energy dissipation structures;
- Stilling basin or plunge pool;
- Outlet channel;
- Erosion protection works;
- Associated drainage systems.

PSDAM 14.3 EXCAVATION

Excavation for the spillway shall extend to the lines, levels and dimensions shown on the Drawings.

All unsuitable material shall be removed and replaced with approved material.

Rock excavation shall be undertaken using controlled blasting techniques where necessary.

The Contractor shall ensure that excavation does not damage adjacent permanent works.

PSDAM 14.4 FOUNDATION PREPARATION

The spillway foundation shall be excavated to competent material.

The exposed foundation shall be cleaned and inspected prior to commencement of concrete works.

Where weak zones, fractures, cavities or weathered rock are encountered, the Contractor shall undertake treatment measures including:

- Dental concrete;
- Foundation grouting;

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- Additional excavation;
- Other approved remedial measures.

PSDAM 14.5 CONCRETE WORKS

All reinforced concrete works shall comply with the relevant project concrete specifications.

The spillway crest, chute, walls, stilling basin and outlet structures shall be constructed to the dimensions shown on the Drawings.

Concrete surfaces exposed to flowing water shall receive the specified finish and shall be free from defects likely to affect hydraulic performance.

PSDAM 14.6 HYDRAULIC PERFORMANCE

The spillway shall be constructed to achieve the hydraulic characteristics specified in the design documentation.

Particular attention shall be paid to:

- Crest geometry;
- Channel alignment;
- Flow transitions;
- Chute profiles;
- Energy dissipation structures.

The spillway system shall safely convey flood flows through the inlet, conveyance section, energy dissipator and downstream channel. safely regulating reservoir releases and facilitating reservoir lowering when required. terminal structures and downstream discharge channels. be founded on competent material. for dam safety and maintenance purposes.

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PSG – FORMWORK, WATERSTOPS AND CONSTRUCTION JOINTS

PSG 1 General

This specification covers the design, supply, erection, maintenance and removal of falsework and formwork for all concrete works associated with the dam, spillway, outlet works, valve chambers, intake structures, energy dissipation structures, diversion works and ancillary concrete structures. It further covers the supply and installation of waterstops, joint fillers, sealants and all construction and movement joints required to provide durable and watertight hydraulic structures.

All falsework, formwork, waterstops and jointing materials shall be designed and constructed to ensure structural stability, dimensional accuracy, durability, satisfactory concrete finish and complete watertightness of all water-retaining structures.

The Contractor shall be fully responsible for the design, adequacy, safety and performance of all falsework and formwork systems used during construction.

PSG 2 Falsework

Falsework shall be designed by a competent person and shall safely support all construction loads, including the weight of wet concrete, reinforcement, construction equipment, personnel, wind loads, vibration loads and any other imposed loads.

The Contractor shall submit detailed falsework drawings and calculations to the Employer's Agent for review prior to construction.

Falsework foundations shall be designed to prevent excessive settlement, differential movement or instability under all anticipated loading conditions.

All timber, steel members, supports, jacks, clamps, scaffolding and bracing shall be free from defects and maintained in a safe condition throughout the duration of the works.

Adequate transverse, longitudinal and diagonal bracing shall be provided to ensure overall stability.

The approval of falsework by the Employer's Agent shall not relieve the Contractor of responsibility for safety or performance.

PSG 3 Formwork

Formwork shall be designed and constructed to produce concrete structures accurately to the dimensions, lines, levels and profiles shown on the drawings.

Formwork shall be sufficiently rigid and watertight to prevent movement, distortion, grout loss or leakage during concrete placement and compaction.

The formwork shall be capable of withstanding all construction loads without excessive deflection.

All surfaces in contact with concrete shall be clean, smooth and free from defects, rust, mortar, oil, dirt or other contaminants that may affect the finished concrete surface.

Formwork shall be designed to permit safe stripping without damage to the concrete.

All exposed corners shall be formed with 20 mm × 20 mm chamfers unless otherwise indicated on the drawings.

The use of damaged, warped or distorted formwork will not be permitted.

Void formers shall be manufactured from material that shall not puncture, tear or be damaged during construction and shall be of such tight construction as to prevent undue loss of the mortar component of the concrete through leakage. The units shall be sufficiently rigid so that they are not deformed during handling or under the pressure of the wet concrete.

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Unless otherwise shown on the Drawings, the metal thickness for mild steel, spiral lock formed (seamed) void formers shall be as follows:

Unbraced void formers

0.6 mm for diameters of up to 600 mm
0.8 mm for diameters exceeding 600 mm and up to 800 mm
1.0 mm for diameters exceeding 800 mm and up to 1m

Braced void formers

0.6 mm for diameters of up to 800 mm
0.8 mm for diameters exceeding 800 mm and up to 1 m
1.0 mm for diameters exceeding 1 m and up to 1.2 m
1.2 mm for diameters exceeding 1.2 m

The thickness specified for braced void formers shall apply to formers internally braced with timber or equivalent braces. The braces shall be at spacings not exceeding 2.0 m and not further than 1.0 m from the end of each unit. Timber cross braces shall consist of members with cross-sectional dimensions of at least 50 mm x 50 mm.

All hollow void-former units shall be provided with a 10 mm diameter drainage hole at each end

Wooden fillets used to form chamfers and recesses on exposed surfaces shall be of new material, unless otherwise authorised by the Employer's Agent.

PSG 4 Surface Finish Requirements

The class of finish shall be appropriate to the function of the structure.

Class F1 Finish

Class F1 finish shall be used for surfaces permanently buried, backfilled or covered by subsequent concrete construction.

Minor surface irregularities shall be permitted provided structural integrity is maintained.

Class F2 Finish

Class F2 finish shall be used for exposed structural surfaces where appearance is of secondary importance.

The finished concrete shall be generally uniform in appearance and free from major honeycombing, fins or surface defects.

Class F3 Finish

Class F3 finish shall be used for visible architectural surfaces, spillway walls, outlet structures, valve chambers and other prominent concrete structures.

The concrete surface shall be smooth, uniform and free from blemishes, excessive blowholes and discoloration.

Class F4 Finish

Class F4 finish shall be used for hydraulic surfaces subject to flowing water including:

- Spillway chutes
- Ogee crests
- Stilling basins
- Outlet conduits
- Energy dissipation structures

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- Intake structures

The finish shall provide a dense, smooth and durable hydraulic surface free from irregularities that could induce cavitation, turbulence or erosion.

PSG 5 Slip Form and Special Formwork

Where slip-form construction is proposed, the Contractor shall submit full details of the proposed system, including:

- Jacking arrangements
- Monitoring procedures
- Alignment control
- Verticality control
- Construction sequence
- Safety provisions

Slip-form operations shall not commence until written approval has been obtained from the Employer's Agent.

PSG 6 Jack rods for sliding formwork

The jack rods, base plates and couplers shall be strong enough to carry the design load under all operating conditions without buckling or becoming distorted or causing damage to the concrete. Jack rods shall remain permanently embedded in the concrete and shall comply with the requirements of Section 12 - Reinforcement. Under no circumstances shall bent rods be used in the work.

The jack rods used shall have a diameter of at least 20 mm.

PSG 7 Construction Joints

Construction joints shall be located only at positions approved by the Employer's Agent.

Joint locations shall be selected to minimise seepage and to maintain structural integrity.

Before placing new concrete against hardened concrete, the existing surface shall be:

- Cleaned
- Roughened where required
- Free from laitance
- Saturated surface dry
- Treated with approved bonding grout where specified

No concrete shall be placed against contaminated or unprepared surfaces.

Filler for expansion joints shall be closed cell, cross-linked polyethylene foam with properties equivalent to materials manufactured by Sondor Industries Ltd. and shall comply with BS 4840.

The thickness of the filler and the density of the material shall be as shown on the Drawings. Typical densities are: 33 kg/m³ (Jointex), 45 kg/m³, 120 kg/m³

PSG 7 Waterstops

Waterstops shall be installed at all construction joints, contraction joints, movement joints and locations shown on the drawings. Natural rubber waterstops shall conform to the SANS co-ordinating specification CKS 388, while PVC waterstops shall conform to the SANS co-ordinating specification CKS 389 in all respects.

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Waterstops shall be manufactured from approved PVC, rubber or hydrophilic materials suitable for hydraulic structures.

For the dam and weir works the following waterstops shall be used:

Embedded Waterstops

PVC centre-bulb waterstops shall be installed in all movement joints and contraction joints in water-retaining structures.

Hydrophilic Waterstops

Hydrophilic bentonite or polymer waterstops shall be installed at construction joints and at interfaces between concrete and foundation treatment systems where indicated on the drawings.

Hydrophilic waterstops shall:

- Expand upon contact with water
- Remain stable during repeated wetting and drying cycles
- Withstand a minimum hydrostatic head of 100 m
- Be securely fixed to prevent displacement during concrete placement

All joints and intersections in waterstops shall be factory manufactured or welded strictly in accordance with the manufacturer's recommendations.

Hydrostatic pressure resistance in accordance with guidelines of ASTM D 5385-93.

UV resistance in accordance with ASTM G 154-16.

PSG 8 Joint Fillers and Sealants

Expansion joint filler shall consist of closed-cell polyethylene foam or approved equivalent.

Joint filler thickness shall be as shown on the drawings.

Sealants shall consist of approved elastomeric polyurethane or polysulphide sealants suitable for hydraulic structures and continuous water exposure.

Sealants shall:

- Remain flexible throughout the design life
- Accommodate joint movement
- Resist ultraviolet exposure
- Resist deterioration from wetting and drying cycles

Bond breakers and primers shall be used where recommended by the sealant manufacturer.

Elastomeric sealant shall be either a two-component polysulphide liquid polymer base complying with the requirements of SANS 110 or a polyethylene-based polyurethane "pouring grade" for horizontal or near horizontal joints or "gun grade" for vertical/overhead joints and joints steeper than 1 in 10 to the horizontal. All elastomeric sealants shall comply with BS EN ISO 11600:2003+A1:2011 Type A1 and shall have a movement tolerance of 25%.

PSG 9 Formwork for Hydraulic Structures

Special attention shall be given to formwork used for:

- Spillway crest structures
- Ogee profiles
- Stilling basins

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- Outlet conduits
- Intake towers
- Valve chambers
- Energy dissipators

The completed formwork shall accurately reproduce the hydraulic profiles shown on the drawings.

Any deviations likely to affect hydraulic performance shall be corrected at the Contractor's expense.

For conduits, tunnels and outlet structures carrying water, controlled permeability formwork liners or similar approved systems may be required to achieve dense concrete surfaces with minimal blowholes and low permeability.

PSG 10 Mortar Bedding for Embedded Steelwork and Hydraulic Equipment

Mortar bedding used for the seating, levelling and support of embedded steelwork, gate frames, valve pedestals, pipe supports, stoplog guides, trash racks, crane rails and other hydraulic or mechanical equipment shall consist of approved sand and either cement-based grout, epoxy mortar or approved proprietary non-shrink grout.

All bedding materials shall be capable of transmitting design loads uniformly to the supporting concrete without excessive deformation, cracking or shrinkage.

The bedding material shall be non-shrink, durable, resistant to water penetration and suitable for permanent exposure to wet and dry conditions encountered in dam and weir structures.

Cement-Based Mortar

Where cement-based mortar is specified, the mortar shall consist of approved washed sand, Ordinary Portland Cement and water mixed to produce a dense and workable material.

The 7-day compressive strength shall not be less than:

- 15 MPa; or
- 1.5 times the average design contact stress,

whichever is greater.

Epoxy Mortar

Where epoxy mortar is specified, it shall consist of an approved epoxy resin system specifically designed for structural bedding and precision grouting applications.

The cured compressive strength shall not be less than:

- 20 MPa; or
- 2.0 times the average design contact stress,

whichever is greater.

Non-Shrink Grout

Non-shrink grout used beneath base plates, embedded steelwork, valve pedestals, gate frames and mechanical equipment shall:

- Exhibit zero shrinkage after curing;
- Possess high early strength characteristics;
- Be resistant to vibration and impact loading;
- Be suitable for continuous wet service conditions.

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The minimum 28-day compressive strength shall be 40 MPa unless otherwise specified on the Drawings.

Surface Preparation

Prior to placing mortar or grout, all concrete surfaces shall be:

- Clean and free of laitance;
- Roughened where necessary;
- Free of oil, grease and loose material;
- Saturated surface dry for cementitious materials.

All embedded steelwork shall be accurately aligned, levelled and securely fixed before grout placement.

Installation

Mortar or grout shall be placed continuously to ensure complete filling of all voids beneath the supported element.

The Contractor shall take all necessary measures to prevent air entrapment and segregation during placement.

The completed bedding shall provide full bearing support over the entire contact area.

PSG 10 Inspection and Acceptance

Prior to concrete placement, the Employer's Agent shall inspect:

- Falsework
- Formwork
- Joint preparation
- Waterstop installation
- Reinforcement
- Embedded items

Concrete placement shall not commence until approval has been obtained.

Any defective formwork, waterstop installation or joint preparation shall be corrected before concrete is placed.

The Contractor shall be responsible for repairing all defects arising from inadequate formwork, falsework, jointing systems or waterstop installation at no additional cost to the Employer.

PSG 11 Design

The Contractor shall carry out the design of all required falsework and formwork. The Contractor shall submit to the Employer's Agent for his consideration and approval, the design and drawings of the falsework and formwork for any structure prior to commencing with construction or manufacture thereof.

Approval of the proposed falsework or formwork by the Employer's Agent shall not relieve the Contractor of his responsibilities for safety or of any of his duties and responsibilities under the Contract.

PSG 12 Falsework

The Contractor shall make his own assessment of the allowable bearing pressure on the founding material and shall design the footings and falsework to guard against overloading, differential settlement and unacceptable overall settlement. In assessing the allowable bearing pressure, due consideration shall be given to the effect which wetting has on the founding material.

In the design of falsework cognisance shall also be taken of the redistribution of load that may occur because of temperature, wind force, stage construction, flooding, and debris and construction equipment.

Particular attention shall be given to the provision of transverse and diagonal bracing as well as web

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stiffeners on cross bearers

PSG 13 Sliding formwork

Prior to fabrication or bringing the assembly and auxiliary equipment to the Site, the Contractor shall submit drawings of the complete sliding formwork assembly to the Employer's Agent for approval. The drawings shall show full details of the forms, jacking frames, access ladders, hanging platforms, safety rails and curing skirts, as well as details of the jacks and jack layouts.

The Contractor shall submit to the Employer's Agent, before sliding commences, an instruction manual wherein the sliding technique, jacking procedure, methods of keeping the formwork level, procedure to be adopted to prevent bonding of the concrete to the forms and method to release the forms in the event of bonding, the instrumentation and monitoring of the slide, correcting for verticality, twisting and levelness, etc., are described in detail.

The formwork panels shall be inclined to give a small taper, the forms being slightly wider at the bottom than at the top. The taper shall be designed to produce the specified concrete thickness at mid-lift level of the form.

The spacing of the jacks with their jack rods shall be so designed that the dead load of the sliding formwork assembly, the frictional load and the mass of materials, personnel and equipment are evenly distributed and within the design capacity of the jacks used.

Concrete sections with dimensions smaller than 200 mm shall not be formed with sliding formwork, unless approved by the Employer's Agent.

PSG 14 Internal formwork to the conduit

Internal formwork for the conduit shall be of robust construction consistent with the number of re-uses required and shall incorporate a purpose made retractable transporting unit.

Access doors at least 600 mm long x 400 mm high shall be provided in both sides and crown at approximately 2.5 m longitudinal centres for man access and placing of concrete. Doors shall be flush fitting, correctly profiled and incorporate rubber seals and locking clamps to prevent inadvertent opening during concreting.

The forward and rear ends of shutter units shall be matched.

Stop-end formworks shall be prefabricated units rigidly connected to the lining formwork, incorporating adjustable timber pieces or expanded metal at the outer perimeter for closure against the irregular rock or shotcrete surface. The complete formwork shall be capable of withstanding, without distortion, the concrete pumping pressure necessary to force the concrete into overbreak cavities.

The shutters shall be capable of being adjusted accurately to the prescribed alignment and shall comply with the specified tolerances given in SC 11.10.

Due to the corrosive nature of the water all waterway surfaces subject to flowing water in the conduit shall be formed using controlled permeability formwork (CPF) liners to obtain a smooth surface free of any blowholes and other blemishes. This shall be obtained by lining the formwork with "Zemdrain lining" by "Max Frank GmbH & Co. KG", Germany, Email info@frank-online.de or similar and approved by the Employer's Agent.

PSG 15 Approval of Drawings

Prior to manufacturing the bearings, the Contractor shall submit the following information to the Employer's Agent for approval:

- a. The manufacturer's specification containing detailed information on the design standards, materials, manufacture and technical data.
- b. The manufacturer's drawings showing the bearing construction and installation details.
- c. Friction properties based on actual tests conducted on the relevant materials.
- d. Evidence of tests and successful previous use, especially with respect to durability and suitability of the bearings for the specified use

PSG 16 Construction

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Unless otherwise specified, the following shall be complied with:

- a. The thickness of the elastomer disc shall be not less than 0.066 times its diameter.
- b. Approved lubricants only shall be used on the Polytetrafluoroethylene (PTFE) sliding surfaces.
- c. The bearing shall be provided with tight-fitting seals to prevent the ingress of dust or deleterious matter onto the moving parts. The seals shall be of an approved type and sufficiently durable to last in excess of 50 years.
- d. The assembled bearing shall be supplied with welded or bolted lugs or straps, temporarily securing the moving parts firmly in position to ensure that no undesirable relative movement occurs before or during construction.
- e. The bearing shall be recessed into adaptor plates or be of such construction as to facilitate removal of the bearing from the installed position without damage to any part of the bearing or the surrounding material after the relevant structural member has been raised by 15 mm or the distance specified.
- f. Anchors and holding-down bolts shall be of the specified material.
- g. Corrosion protection of all exposed steel surfaces, except for the stainless-steel sliding plate, shall involve the following treatment:

Preparing the surfaces by abrasive blasting to a finish equal to the Sa3 finish of Swedish Standard SIS 05 59 00.

Spraying the surfaces with zinc to comply with the requirements of SANS 2063 for type Zn 150 surfacing.

Coating the zinc-sprayed surfaces within 4 hours with a sealer compatible with the zinc and the subsequent coats of paint.

Applying a coat of chlorinated rubber paint with a minimum of 75 micrometers of dry-film thickness and of a colour which differs from that of the final coat of paint.

Applying a final coat of chlorinated rubber paint with a minimum of 75 micrometers of dry-film thickness and of dark grey colour.

Surfaces in contact with concrete shall be sprayed with zinc so that it complies with the requirements of SANS 1391 Part 1 for type Zn 150 surfacing.

PSBL – BLASTING WORKS

PSBL 1 GENERAL

This specification covers all drilling, blasting, controlled blasting, pre-splitting, smooth blasting, rock fragmentation, vibration monitoring, safety measures and associated works required for excavation and quarry development under this Contract.

The Contractor shall be responsible for the design, execution, supervision and control of all blasting operations necessary for the completion of the Works.

Blasting shall be undertaken only where approved by the Employer's Agent and shall comply with all applicable legislation governing the storage, transportation, handling and use of explosives.

The Contractor shall obtain all permits, licences and approvals required for blasting operations and shall employ suitably qualified and licensed blasting personnel.

PSBL 2 APPLICABLE LEGISLATION

All blasting operations shall comply with:

- Occupational Health and Safety Act;
- Explosives Act;
- Mine Health and Safety Act where applicable;
- SANS Standards relating to blasting;

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- Local Authority requirements;
- Environmental Authorisation conditions;
- Approved Environmental Management Programme (EMPr);
- Approved Health and Safety Plan.

PSBL 3 BLASTING METHOD STATEMENTS

At least twenty-eight (28) days prior to commencement of blasting, the Contractor shall submit a detailed blasting method statement for approval.

The method statement shall include:

- Blasting methodology;
- Drilling patterns;
- Burden and spacing;
- Charge quantities;
- Delay sequencing;
- Vibration control measures;
- Fly-rock prevention measures;
- Blast monitoring procedures;
- Public safety measures;
- Environmental mitigation measures;
- Emergency procedures;
- Notification procedures.

No blasting shall commence until the method statement has been approved.

PSBL 4 TRIAL BLASTING

The Employer's Agent may require trial blasts to demonstrate the Contractor's ability to:

- Achieve required fragmentation;
- Control overbreak;
- Control vibration;
- Protect adjacent structures;
- Prevent damage to foundation rock.

The Contractor shall modify blast designs as required following trial blasting.

PSBL 5 FOUNDATION BLASTING

Where blasting is required for dam, weir, spillway, intake tower or pump station foundations, controlled blasting techniques shall be employed to prevent damage to the final founding surface.

The Contractor shall minimise:

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- Overbreak;
- Fracturing;
- Loosening of foundation rock;
- Disturbance of adjacent rock masses.

The Employer's Agent may require the final excavation levels to be completed using line drilling, smooth blasting, cushion blasting or mechanical excavation methods.

Any damaged foundation rock shall be removed and replaced at the Contractor's expense.

PSBL 6 PRE-SPLITTING AND SMOOTH BLASTING

Pre-splitting shall be employed where necessary to:

- Protect dam abutments;
- Protect spillway walls;
- Protect foundation excavations;
- Form quarry faces;
- Produce stable rock slopes.

The Contractor shall ensure that final excavation faces are neat, stable and free from excessive overbreak.

The use of uncontrolled production blasting adjacent to final excavation surfaces shall not be permitted.

PSBL 7 QUARRY BLASTING

The Contractor shall establish and operate approved quarry areas for the production of:

- Rockfill;
- Riprap;
- Drainage aggregate;
- Concrete aggregate where approved.

Blasting shall be designed to produce durable material suitable for the intended purpose while minimising excessive fines and wastage.

The quarry operation shall comply with all environmental and safety requirements.

PSBL 8 PROTECTION OF EXISTING INFRASTRUCTURE

The Contractor shall take all necessary precautions to protect:

- Existing buildings;
- Roads;
- Pipelines;
- Electrical infrastructure;
- Survey beacons;
- River channels;

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- Existing dams and structures;
- Adjacent properties.

The Contractor shall be responsible for all damage resulting from blasting operations.

PSBL 9 VIBRATION MONITORING

The Contractor shall undertake vibration monitoring throughout blasting operations.

Monitoring equipment shall be installed at locations approved by the Employer's Agent.

Peak Particle Velocity (PPV) limits shall comply with accepted blasting standards and shall not exceed levels capable of causing damage to:

- Existing structures;
- Foundations;
- Utilities;
- Sensitive equipment.

Monitoring records shall be submitted after each blast.

PSBL 10 FLY-ROCK CONTROL

The Contractor shall ensure that blasting operations do not result in the projection of rock fragments beyond the designated blast area.

Where necessary, blasting mats, blast curtains or other approved containment measures shall be employed.

Any blast resulting in fly-rock outside the approved exclusion zone shall be regarded as a serious safety incident.

PSBL 11 ENVIRONMENTAL REQUIREMENTS

The Contractor shall minimise:

- Dust generation;
- Noise impacts;
- Ground vibration;
- Air blast overpressure;
- Damage to vegetation;
- Sedimentation of watercourses.

Watercourses shall be protected from contamination resulting from blasting operations.

PSBL 12 INSPECTION AND ACCEPTANCE

Following each blast, the Contractor shall inspect the excavation and remove all loose and unstable rock.

The Employer's Agent shall inspect all final foundation surfaces before any concrete placement, grouting or embankment construction commences.

Approval of a blasted surface shall not relieve the Contractor of responsibility for damage caused by blasting.

PSBL 13 MEASUREMENT AND PAYMENT

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The tendered rates for excavation in hard rock shall be deemed to include full compensation for:

- Drilling;
- Explosives;
- Blasting accessories;
- Licences and permits;
- Blast design;
- Vibration monitoring;
- Safety measures;
- Fly-rock protection;
- Environmental controls;
- Removal of blasted material;
- Disposal of unsuitable material;
- All labour, plant and supervision.

No separate payment shall be made for blasting unless specifically provided for in the Bill of Quantities.

PSM – STRUCTURAL STEELWORK AND METALWORK

PSM 1 GENERAL

This section covers the design (where applicable), manufacture, supply, fabrication, galvanizing, painting, delivery, erection, testing and commissioning of all structural steelwork and metalwork associated with the Works.

The work shall include, but not be limited to:

- Structural steel frames
- Access platforms
- Walkways
- Stairways
- Handrails and guardrails
- Ladders
- Pipe supports
- Equipment support structures
- Trash racks
- Stoplog guides
- Sluice gate frames
- Scour gate frames
- Valve supports

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- Penstock supports
- Steel covers and gratings
- Embedded steelwork
- Lifting beams
- Gantry crane support structures
- Anchor bolts
- Miscellaneous metalwork

All steelwork shall be designed and constructed to ensure long-term durability under the environmental conditions applicable to dam and hydraulic structures.

PSM 2 APPLICABLE STANDARDS

Unless otherwise specified, all steelwork shall comply with the latest editions standards

(a)	I and H sections	BS EN 10365:2017
(b)	Metric channels	DIN 1026
(c)	Imperial channels	BS EN 10365:2017
(d)	Angles	ISO R/657 and BS EN 10365:2017
(e)	IPE sections	DIN 1025

The Contractor shall ensure that all materials, fabrication procedures, welding procedures, coatings and erection methods comply with approved standards.

PSM 3 MATERIALS

PSM 3.1 Structural Steel

Structural steel sections, plates and members shall be new and free from defects.

Structural steel shall have a minimum yield strength of 300 MPa unless otherwise indicated on the Drawings.

Steel shall be free from:

- Cracks
- Laminations
- Excessive corrosion
- Distortion
- Mechanical damage

Mill certificates shall be submitted for all structural steel supplied.

PSM 3.2 Stainless Steel

All stainless steel components exposed to water, splash zones or corrosive environments shall be Grade 316 stainless steel unless otherwise specified.

Items may include:

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- Anchor bolts
- Fasteners
- Trash rack components
- Gate guides
- Embedded fixings
- Handrails
- Ladders

Stainless steel shall be resistant to corrosion, pitting and staining.

PSM 3.3 Bolts, Nuts and Washers

Bolts, nuts and washers shall be high-strength structural fasteners.

Unless otherwise specified:

- External fixings shall be hot-dip galvanized.
- Fixings in contact with water shall be stainless steel Grade 316.

Bolted connections shall be designed to withstand all operational loads.

Bolts and nuts (other than friction grip) shall be hexagonal headed and comply with the requirements of SANS 1700 or SANS 1143 as applicable.

PSM 4 SHOP DRAWINGS

Prior to fabrication, the Contractor shall submit detailed shop drawings for approval.

Shop drawings shall indicate:

- Member sizes
- Material grades
- Weld details
- Bolt details
- Connection details
- Surface treatment systems
- Dimensions
- Erection marks

No fabrication shall commence until approval has been obtained.

PSM 5 FABRICATION

All fabrication shall be carried out by experienced personnel in approved workshops.

Fabrication shall be performed using approved procedures to ensure dimensional accuracy and structural integrity.

Steel members shall be accurately cut, drilled and assembled.

Flame-cut edges shall be dressed smooth.

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Sharp edges and burrs shall be removed.

Distorted members shall not be incorporated into the Works.

PSM 6 WELDING

All welding shall be carried out by qualified welders using approved welding procedures.

Welds shall be:

- Continuous where required
- Uniform in appearance
- Free from cracks
- Free from porosity
- Free from slag inclusions

The Employer's Agent may require non-destructive testing of selected welds.

Defective welds shall be removed and replaced at the Contractor's expense.

PSM 7 GALVANIZING

Unless otherwise specified, all exposed carbon steel components shall be hot-dip galvanized after fabrication.

Galvanizing shall provide complete protection to all exposed surfaces, including:

- Internal corners
- Bolt holes
- Welded areas
- Hollow sections

The average zinc coating thickness shall not be less than 85 microns.

Damaged galvanizing shall be repaired using approved zinc-rich repair systems.

PSM 8 PAINTING AND CORROSION PROTECTION

Where painting is specified in addition to galvanizing, a duplex coating system shall be used.

The coating system shall generally comprise:

- Surface preparation
- Zinc-rich primer
- Intermediate epoxy coating
- Polyurethane finish coat

The total dry film thickness shall not be less than 250 microns unless otherwise specified.

Particular attention shall be given to steelwork exposed to:

- Splash zones
- Continuous moisture
- Condensation

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- Water treatment chemicals

PSM 9 EMBEDDED STEELWORK

Embedded steelwork shall include:

- Anchor frames
- Embedded plates
- Gate frames
- Penstock frames
- Pipe support brackets
- Stoplog guides

Embedded components shall be accurately positioned and securely fixed before concrete placement.

Temporary supports shall be provided to prevent movement during concreting.

Any misalignment shall be corrected at the Contractor's expense.

PSM 10 ACCESS LADDERS, STAIRWAYS, WALKWAYS AND HANDRAILS

All access structures shall provide safe access for operation and maintenance personnel.

Handrails shall be provided wherever there is a risk of falling.

Unless otherwise approved:

- Handrail height shall be 1100 mm.
- Mid-rails shall be provided.
- Toe plates shall be installed where required.

Walkways shall be designed for maintenance loading and shall have non-slip surfaces.

Ladders shall incorporate safety hoops where required by applicable regulations.

PSM 11 GRATINGS AND COVERS

Steel gratings shall be provided where shown on the Drawings.

Gratings shall:

- Be galvanized
- Have anti-slip surfaces
- Be removable for maintenance
- Be capable of supporting maintenance loads

Access covers shall be lockable where security is required.

PSM 12 TRASH RACKS

Trash racks shall be provided at intake structures as shown on the Drawings.

Trash racks shall:

- Prevent entry of debris

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- Be structurally designed for hydraulic loading
- Be corrosion resistant
- Be removable for cleaning and maintenance

All welds and connections shall be designed to withstand operational loads.

PSM 13 GATE FRAMES, STOPLOG GUIDES AND PENSTOCK SUPPORTS

Gate frames, stoplog guides, penstock supports and associated steelwork shall be fabricated to the tolerances shown on the Drawings.

Bearing surfaces shall be machined where required.

Frames shall be installed plumb, level and accurately aligned to ensure proper operation of gates and stoplogs.

The Contractor shall verify dimensions before fabrication.

PSM 14 ANCHOR BOLTS

Anchor bolts shall be supplied complete with:

- Nuts
- Washers
- Templates
- Holding assemblies

Anchor bolts shall be accurately positioned and secured before concrete placement.

The Contractor shall check alignment and levels before casting.

Misaligned anchor bolts shall be rectified at the Contractor's cost.

PSM 15 ERECTION

Steelwork shall be erected using approved methods and suitable lifting equipment.

Temporary bracing shall be provided where necessary to maintain stability during erection.

All members shall be aligned, levelled and securely fixed before final tightening of connections.

No member shall be forced into position.

PSM 16 INSPECTION AND TESTING

The Employer's Agent may inspect steelwork at any stage of manufacture or erection.

Inspection may include:

- Material certification review
- Dimensional checks
- Weld inspection
- Coating inspection
- Galvanizing inspection
- Trial assembly

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The Contractor shall provide access and assistance for all inspections.

PSM 17 MEASUREMENT AND PAYMENT

Payment for structural steelwork and metalwork shall include full compensation for:

- Design where applicable
- Materials
- Fabrication
- Welding
- Galvanizing
- Painting
- Delivery
- Storage
- Erection
- Testing
- Temporary supports
- All incidentals necessary to complete the Works.

No separate payment shall be made unless specifically provided for in the Bill of Quantities

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PSW – WEIR WORKS

PSW 1 – GENERAL REQUIREMENTS

PSW 1.1 SCOPE

The Works shall comprise the design verification, setting out, excavation, foundation preparation, foundation treatment, concrete construction, reinforcement, formwork, waterstops, scour facilities, energy dissipation structures, hydro-mechanical equipment, instrumentation, erosion protection works, testing, commissioning and all associated works necessary for the construction of the Empuluzi Weir.

The weir shall abstract and transfer a design flow of 0.16 m³/s via a DN600 gravity transfer pipeline to the Off-Channel Storage Dam (OCSD).

The weir shall be approximately 12 m high and founded on competent bedrock identified during the geotechnical investigations.

All works shall comply with:

- Dam Safety Regulations
- National Water Act
- SANS 1200
- SANS 2001
- DWS Dam Safety Requirements
- ICOLD Guidelines
- Approved Design Drawings

PSW 2 – SITE INVESTIGATIONS AND VERIFICATION

Before commencing construction, the Contractor shall verify:

- Existing river levels;
- River geometry;
- Foundation conditions;
- Bedrock levels;
- Groundwater conditions;
- Existing services;
- Access conditions.

Any discrepancies between site conditions and design assumptions shall immediately be reported to the Employer's Agent.

No claims arising from failure to verify site conditions shall be entertained.

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PSW 3 – RIVER DIVERSION WORKS

PSW 3.1 GENERAL

The Contractor shall design, construct, operate and remove all temporary river diversion works required for construction of the weir.

The diversion system shall safely convey river flows during construction.

PSW 3.2 DIVERSION FACILITIES

Diversion facilities may comprise:

- Cofferdams;
- Temporary channels;
- Diversion culverts;
- Diversion pipes;
- Pumps;
- Temporary flood protection measures.

The Contractor shall submit detailed diversion designs prepared by a Professional Engineer.

PSW 3.3 FLOOD PROTECTION

The Contractor shall maintain the diversion works throughout construction and shall be responsible for all flood damage resulting from inadequate diversion arrangements.

PSW 4 – FOUNDATION EXCAVATION

PSW 4.1 GENERAL

Excavation shall extend to the levels shown on the Drawings or as directed by the Employer's Agent.

All unsuitable material shall be removed.

Excavation shall continue until competent founding conditions are achieved.

PSW 4.2 ROCK EXCAVATION

Rock excavation shall be undertaken using controlled blasting methods.

Blasting shall not damage:

- Existing structures;
- Foundation rock;
- Adjacent property;
- River banks.

PSW 4.3 CLEANING OF FOUNDATION

Prior to concrete placement the foundation shall be:

- Scaled;
- Washed;
- Air cleaned;
- Inspected and approved.

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PSW 5 – FOUNDATION TREATMENT

PSW 5.1 GENERAL

The Contractor shall undertake all foundation treatment measures required to ensure:

- Stability;
- Seepage control;
- Structural integrity.

PSW 5.2 DENTAL CONCRETE

All depressions, fissures, cavities and irregularities in the bedrock shall be filled using dental concrete.

Concrete shall be placed only after approval of cleaned surfaces.

PSW 5.3 CONTACT GROUTING

Contact grouting shall be carried out where directed.

The purpose shall be to eliminate voids beneath the structure.

PSW 6 – GROUT CURTAIN

PSW 6.1 GENERAL

A grout curtain shall be installed beneath the weir to reduce seepage through the foundation.

The grout curtain shall extend into moderately weathered to fresh rock.

PSW 6.2 GROUTING

The curtain shall consist of:

- Primary holes;
- Secondary holes;
- Tertiary holes.

Grouting shall be carried out using cement-bentonite grout.

PSW 6.3 SPACING

Primary hole spacing shall generally be 2 m to 3 m.

Secondary and tertiary holes shall be drilled as required.

PSW 6.4 REFUSAL CRITERIA

Final permeability shall be less than:

3 Lugeons

or as directed by the Employer's Agent.

PSW 7 – STRUCTURAL CONCRETE

PSW 7.1 GENERAL

Concrete shall comply with PSCON and SANS 1200G.

PSW 7.2 CONCRETE CLASSES

Concrete strengths shall be as shown on the Drawings.

Typical classes may include:

Structure	Class
Weir Body	30/19

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Structure	Class
Aprons	30/19
Energy Dissipators	35/19
Scour Structures	35/19
Blinding	15 MPa

PSW 7.3 MASS CONCRETE

Mass concrete temperature control measures shall be implemented.

The Contractor shall monitor:

- Concrete temperatures;
- Placement temperatures;
- Thermal gradients.

Thermal cracking shall not be permitted.

PSW 8 – REINFORCEMENT

All reinforcement shall comply with SANS requirements.

The Contractor shall provide:

- Cutting schedules;
- Bending schedules;
- Bar lists;
- As-built records.

PSW 9 – JOINTS AND WATERSTOPS

Construction joints shall be located only at approved positions.

All water-retaining joints shall incorporate:

- PVC waterstops;
- Hydrophilic bentonite waterstops;

or other approved systems.

Waterstops shall be continuous through the full section.

PSW 10 – SCOUR OUTLET SYSTEM

PSW 10.1 GENERAL

The weir shall incorporate a scour facility to facilitate:

- Sediment flushing;
- Reservoir maintenance;
- Emergency drawdown.

PSW 10.2 SCOUR GATE

The scour outlet shall comprise a scour gate or approved equivalent.

The system shall operate automatically during flood events where required by the design.

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PSW 10.3 Operation

The Contractor shall demonstrate satisfactory operation during commissioning.

PSW 11 – ABSTRACTION WORKS

PSW 11.1 General

The abstraction works shall provide reliable diversion of the approved design flow of:

0.16 m³/s

to the Off-Channel Storage Dam.

PSW 11.2 INTAKE ARRANGEMENT

The intake structure shall:

- Prevent excessive sediment entry;
- Prevent debris ingress;
- Facilitate maintenance access.

Trash screens shall be provided.

PSW 12 – DN600 TRANSFER PIPELINE CONNECTION

The Contractor shall construct and connect the DN600 gravity transfer pipeline from the abstraction structure to the OCSD inlet works.

The pipeline inlet level shall be approximately:

1308.2 masl

or as shown on the Drawings.

All valves, fittings, thrust blocks and ancillary works shall be included.

PSW 13 – ENERGY DISSIPATION WORKS

Energy dissipation structures shall be constructed downstream of the weir.

These may include:

- Stilling basins;
- Baffle blocks;
- Aprons;
- Riprap protection;
- Plunge pools.

The Contractor shall construct all features to the approved hydraulic design.

PSW 14 – EROSION PROTECTION

The Contractor shall protect:

- River banks;
- Spillway outlets;

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- Scour outlet discharge areas;
- Abutments;
- Embankment tie-ins.

Protection shall include:

- Riprap;
- Reno mattresses;
- Gabions;
- Concrete protection;
- Vegetative rehabilitation.

PSW 15 – INSTRUMENTATION AND MONITORING

The Contractor shall supply and install all instrumentation required by the Dam Safety Design Report, including:

- Uplift pressure monitoring points;
- Joint monitoring points;
- Settlement markers;
- Survey monuments;
- Flow measurement devices;
- Any additional instrumentation shown on the Drawings.

PSW 16 – TESTING, COMMISSIONING AND HANDOVER

The Contractor shall test and commission:

- Scour gates;
- Hydro-mechanical equipment;
- Instrumentation;
- Flow measurement systems;
- Electrical systems;
- Control systems.

Operation and Maintenance Manuals shall be provided prior to Taking Over.

Training shall be provided to Employer personnel.

Successful commissioning shall be a prerequisite for Practical Completion and Taking Over of the Works

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PARB: ACCESS ROAD AND BRIDGES

The following SANS specifications shall apply

SANS 1200 C

SANS 1200 D

SANS 1200 DB

SANS 1200 DM

SANS 1200 LB

SANS 1200 LE

PSGEN – APPLICABLE SPECIFICATIONS, STANDARDS AND REFERENCES

PSGEN 1 GENERAL

All work executed under this Contract shall comply with the latest editions of the applicable South African National Standards (SANS), the Occupational Health and Safety Act, the National Environmental Management Act, Department of Water and Sanitation requirements, Dam Safety Regulations, and the Project Specifications contained herein.

The Contractor shall ensure that all materials, workmanship, testing, construction methods and quality control procedures comply with the requirements of the relevant SANS specifications and the Project Specifications. Where conflicts occur between standards, the more stringent requirement shall apply unless otherwise instructed by the Engineer.

PSGEN 2 APPLICABLE SANS 1200 SPECIFICATIONS

The following SANS 1200 Standardized Specifications shall apply to the Works where relevant:

(a) SANS 1200 A – General Requirements

This specification shall apply to all work under the Contract and shall govern matters relating to establishment, supervision, setting out, quality control, temporary works, protection of works, health and safety, environmental compliance, measurements and payment.

(b) SANS 1200 C – Site Clearance

This specification shall apply to clearing, grubbing, removal of vegetation, demolition of minor structures, stripping of topsoil and preparation of construction areas, borrow pits, quarry sites, dam footprints, pipeline servitudes and access roads.

(c) SANS 1200 D – Earthworks

This specification shall apply to all excavation, foundation preparation, cut and fill operations, spoil disposal, borrow excavation, embankment construction, trench excavation, backfilling, haulage and compaction works.

(d) SANS 1200 DB – Roadbed Preparation

This specification shall apply to preparation of road formations, access roads, haul roads and permanent road infrastructure associated with the Works.

(e) SANS 1200 DM – Layer Works

This specification shall apply to imported fill, selected layer material, gravel wearing courses, road pavement layers and associated compaction requirements.

(f) SANS 1200 G – Structural Concrete

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This specification shall apply to all reinforced concrete, mass concrete, blinding concrete, spillway structures, outlet works, bridge structures, valve chambers, retaining structures and hydraulic structures forming part of the Works.

(g) SANS 1200 GA – Small Concrete Structures

This specification shall apply to culverts, catchpits, manholes, headwalls, outlet structures, drainage structures and other small concrete structures.

(h) SANS 1200 H – Structural Steelwork

This specification shall apply to fabrication, corrosion protection, transportation and erection of structural steel, gates, stoplogs, pipe supports, access platforms, handrails, ladders and miscellaneous metalwork.

(i) SANS 1200 LB – Pipe Culverts

This specification shall apply to pipe culverts, drainage culverts, associated bedding, backfilling, headwalls and outlet structures.

(j) SANS 1200 LE – Stormwater Drainage

This specification shall apply to open drains, side drains, catchwater drains, mitre drains, lined channels and stormwater control systems.

(k) SANS 1200 L – Medium Pressure Pipelines

This specification shall apply to raw water pipelines, gravity pipelines, rising mains and associated fittings forming part of the Works.

(l) SANS 1200 M – Ancillary Concrete Works

This specification shall apply to concrete bases, plinths, chambers and miscellaneous concrete works not covered elsewhere.

(m) SANS 1200 MJ – Pipework (Steel)

This specification shall apply where steel pipelines, specials, manifolds or fabricated steel pipework are incorporated into the Works.

PSAT – ACCOMMODATION OF TRAFFIC

PSAT 1 General

The Contractor shall be responsible for the safe accommodation of all public and construction traffic affected by the Works for the entire duration of the Contract. Traffic accommodation shall include the provision, maintenance, operation and removal of all temporary traffic management measures necessary to ensure the safe and efficient movement of vehicles, pedestrians, construction plant and emergency services through and around the Works.

The Contractor shall conduct all operations in a manner that minimises inconvenience and disruption to road users, local communities, adjacent landowners, businesses and public services. Access to properties, farms, businesses, municipal infrastructure, water supply facilities and emergency services shall be maintained at all times unless otherwise approved by the Engineer.

All traffic accommodation measures shall comply with the requirements of the National Road Traffic Act, SANS 1200 LB (where applicable), the South African Road Traffic Signs Manual (SARTSM), and all relevant statutory requirements.

PSAT 2 Traffic Management Plan

Prior to commencing any work affecting existing roads, access routes or public movement, the Contractor shall prepare and submit a detailed Traffic Management Plan (TMP) for approval by the Engineer.

The Traffic Management Plan shall include:

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- Site-specific traffic control arrangements;
- Temporary road closures and diversions;
- Construction access routes;
- Traffic signage layouts;
- Flagmen positions;
- Temporary speed restrictions;
- Pedestrian accommodation measures;
- Emergency access arrangements;
- Night-time traffic control measures;
- Public notification procedures;
- Maintenance procedures for traffic control devices.

No road closure or traffic diversion shall be implemented without prior written approval from the Engineer and relevant road authority.

PSAT 3 Temporary Traffic Control Devices

The Contractor shall provide, erect, maintain and remove all temporary traffic control devices required for the Works.

Traffic control devices shall include:

- Regulatory signs;
- Warning signs;
- Direction signs;
- Information signs;
- Delineators;
- Traffic cones;
- Barricades;
- Temporary road markings;
- Flashing warning lights;
- Hazard markers;
- Reflective devices.

All signs shall be maintained in a clean, visible and serviceable condition throughout the Contract period.

Damaged, missing or vandalised signs shall be replaced immediately at the Contractor's cost.

PSAT 4 Flagmen and Traffic Controllers

Where required by the Engineer, suitably trained and competent traffic controllers shall be provided to regulate traffic through construction areas.

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Traffic controllers shall:

- Wear high-visibility reflective clothing;
- Be equipped with approved stop/go signs;
- Be fully trained in traffic control procedures;
- Remain on duty whenever traffic hazards exist.

The Contractor shall ensure adequate supervision and communication between traffic controllers at all times.

PSAT 5 Temporary Access Roads and Diversions

Where existing roads, tracks or access routes are affected by the Works, the Contractor shall construct and maintain temporary access roads and diversions as required.

Temporary roads shall:

- Provide safe passage for all authorised users;
- Be adequately drained;
- Be free from excessive dust, mud and potholes;
- Be maintained in a serviceable condition at all times.

Upon completion of the Works, temporary roads and diversions shall be removed unless otherwise instructed by the Engineer, and the affected areas reinstated to their original condition.

PSAT 6 Access to Properties and Services

Access to:

- Private properties;
- Farms;
- Businesses;
- Municipal infrastructure;
- Utility services;
- Water supply facilities;
- Emergency services;

shall be maintained throughout the Contract period.

Where temporary interruptions are unavoidable, the Contractor shall provide suitable alternative access arrangements and shall notify affected parties at least 48 hours in advance unless otherwise approved by the Engineer.

PSAT 7 Construction Traffic

Construction vehicles and plant shall use only approved haul routes and access roads.

The Contractor shall:

- Prevent damage to existing roads;

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- Remove mud and debris deposited on public roads;
- Control dust generated by construction traffic;
- Enforce speed restrictions on construction vehicles;
- Prevent unsafe parking of construction vehicles.

Any damage caused to existing roads, road furniture or services by the Contractor shall be repaired at the Contractor's expense.

PSAT 8 Pedestrian Safety

Where pedestrians may be affected by the Works, the Contractor shall provide safe pedestrian routes, barriers, warning signs and crossing points.

Pedestrian facilities shall:

- Remain accessible at all times;
- Be adequately illuminated where required;
- Be separated from construction activities wherever practical.

Special consideration shall be given to schools, clinics, public facilities and areas with high pedestrian activity.

PSAT 9 Emergency Access

The Contractor shall ensure that unrestricted access is maintained for:

- Ambulances;
- Fire services;
- Police services;
- Disaster management vehicles;
- Municipal emergency response teams.

Emergency access routes shall remain operational at all times.

PSAT 10 Dust and Mud Control

The Contractor shall prevent construction traffic from creating unsafe conditions on public roads.

Measures shall include:

- Watering of haul roads;
- Road sweeping;
- Wheel washing facilities where required;
- Removal of mud, soil and debris from paved roads.

Failure to maintain roads in a safe condition may result in the Engineer instructing the suspension of affected operations until corrective measures are implemented.

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PSRD – ACCESS ROADS, DRAINAGE AND ROADWORKS

PSRD 1 – Temporary Access Roads

General

The Contractor shall design, construct, maintain and remove all temporary access roads required for the execution of the Works. Temporary access roads shall provide safe and reliable access to all construction areas, borrow pits, quarries, batching plants, stockpile areas, camps, dam embankment works, weir works and pipeline routes.

The location and alignment of temporary access roads shall be approved by the Engineer prior to construction. The Contractor shall minimise disturbance to the natural environment and existing land uses and shall comply with all requirements of the Environmental Management Programme (EMPr).

Temporary roads shall be designed to accommodate anticipated construction traffic, including heavy haulage vehicles, concrete delivery trucks, articulated dump trucks, cranes, excavators and abnormal loads.

Construction Requirements

Temporary access roads shall be constructed by clearing and grubbing the route, removing unsuitable material and placing approved gravel wearing course material compacted to not less than 95% Modified AASHTO density. The minimum road width shall be sufficient to safely accommodate construction traffic and passing bays shall be provided where necessary.

The Contractor shall maintain temporary roads throughout the Contract period and shall regularly grade, water and repair the roads to ensure safe operation under all weather conditions.

Adequate drainage shall be provided to prevent ponding, erosion and deterioration of the road surface.

Reinstatement

Upon completion of the Works, temporary roads not required for future operation and maintenance shall be removed and the affected areas rehabilitated to the satisfaction of the Engineer and environmental authorities.

PSRD 2 – Permanent Access Roads

General

Permanent access roads shall provide all-weather access to the dam, weir, outlet works, pump stations, valve chambers, electrical installations, operational facilities and associated infrastructure.

Roads shall be designed and constructed to accommodate operational, maintenance and emergency vehicles throughout the design life of the project.

Earthworks

All unsuitable material shall be removed and replaced with approved fill material. Fill material shall be placed in layers and compacted to a minimum of 95% Modified AASHTO density.

The road formation shall be proof-rolled prior to placement of pavement layers.

Pavement Layers

The road pavement shall consist of approved selected subgrade, subbase, base course and wearing course materials as indicated on the drawings and specifications.

Material quality, layer thicknesses and compaction requirements shall comply with the approved pavement design.

The completed road surface shall be free from potholes, rutting, corrugations and soft spots.

Geometric Standards

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Road alignment, gradients, cross-falls, curve radii and sight distances shall comply with accepted engineering practice and the approved design drawings.

Road widths shall be sufficient to accommodate maintenance vehicles and emergency access requirements.

PSRD 3 – Road Drainage

General

The Contractor shall construct all road drainage works necessary to collect, convey and safely discharge stormwater without causing erosion, flooding or damage to road infrastructure.

Drainage systems shall be designed to prevent deterioration of pavement layers and shall remain fully functional throughout the design life of the road.

Side Drains

Side drains shall be excavated to the dimensions shown on the drawings and graded to provide positive drainage.

Drain slopes shall be protected against erosion by:

- Grassing;
- Stone pitching;
- Reno mattresses;
- Concrete lining;
- Other approved erosion protection measures.

The finished drains shall be free of obstructions and provide uninterrupted stormwater flow.

Mitre Drains and Catchwater Drains

Mitre drains and catchwater drains shall be constructed where necessary to intercept runoff and divert water away from road embankments and cuttings.

The spacing and layout of drains shall be determined by the approved design and site conditions.

Erosion Protection

All drainage outlets shall be protected against scour using approved rock riprap, gabions, concrete aprons or similar approved measures.

The Contractor shall repair all erosion damage occurring during the Contract period.

PSRD 4 – Culverts

General

Culverts shall be constructed at locations indicated on the drawings or as directed by the Engineer to safely convey water beneath roads and access routes.

Culverts shall be designed to accommodate design flood flows without overtopping, erosion or structural damage.

Excavation and Bedding

Excavation for culverts shall extend to approved founding levels.

Unsuitable material shall be removed and replaced with approved bedding material.

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Pipe bedding shall comply with the manufacturer's recommendations and approved standard details.

Culvert Pipes

Culvert pipes shall be reinforced concrete pipes, HDPE pipes or other approved pipe systems as specified on the drawings.

Pipes shall be installed true to line and level with tightly sealed joints.

Damaged pipes shall not be incorporated into the Works.

Backfilling

Backfill material shall consist of approved selected material free from oversized rock, organic matter and deleterious substances.

Backfilling shall be placed symmetrically on both sides of the culvert and compacted to not less than 95% Modified AASHTO density.

Headwalls and Wingwalls

Concrete headwalls, wingwalls and outlet structures shall be constructed where indicated on the drawings.

Concrete shall comply with the requirements of the structural concrete specification.

Scour Protection

Inlets and outlets shall be protected against erosion and scour by means of riprap, gabions, concrete aprons or other approved measures.

PSRD 5 – Road Signs and Road Markings

General

Road signs and markings shall be provided for all permanent access roads where required for operational safety and traffic management.

All signs shall comply with the South African Road Traffic Signs Manual (SARTSM) and relevant statutory requirements.

Road Signs

Road signs may include:

- Regulatory signs;
- Warning signs;
- Information signs;
- Direction signs;
- Speed restriction signs;
- Dam safety warning signs;
- Restricted access signs;
- Emergency contact information signs.

Sign supports shall be galvanised steel posts securely founded in concrete foundations.

Signs shall be installed plumb, visible and protected from damage.

Road Markings

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Road markings shall be applied using approved reflective road-marking paint or thermoplastic material.

Markings may include:

- Centre lines;
- Edge lines;
- Stop lines;
- Direction arrows;
- Parking bays;
- Hazard markings;
- Pedestrian crossings where required.

The surface shall be clean and dry before application.

Maintenance

The Contractor shall maintain all signs and markings until Taking Over of the Works.

Damaged, faded or vandalised signs shall be replaced immediately.

Road markings that become worn or illegible shall be reinstated to the satisfaction of the Engineer.

PSBR – BRIDGE WORKS

PSBR 1 – Bridge Foundations

General

Bridge foundations shall be designed and constructed to safely transmit all vertical, horizontal, impact, hydraulic and seismic loads from the bridge structure to the underlying founding strata. Foundation works shall be based on the approved geotechnical investigations and shall comply with the requirements of the Contract Drawings and Specifications.

Excavation

Excavation for foundations shall be carried out to the lines, levels and dimensions shown on the Drawings. All unsuitable material, loose rock, soft zones, organic matter, alluvium and weathered material shall be removed to expose competent founding material.

Where over-excavation occurs, the Contractor shall make good the excavation using mass concrete or other approved material at his own cost.

Foundation Preparation

The founding surface shall be cleaned of all loose material, standing water, mud and deleterious substances before concrete placement. Rock foundations shall be pressure-cleaned and inspected by the Engineer prior to concreting.

Where fractured or irregular rock surfaces occur, dental concrete shall be placed to provide a sound and level founding platform.

Foundation Types

Foundations may consist of:

- Spread footings;
- Mass concrete foundations;

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- Reinforced concrete footings;
- Piled foundations;
- Rock anchors;
- Combination foundation systems.

The type of foundation shall be as shown on the Drawings.

Foundation Acceptance

No concrete shall be placed until the Engineer has inspected and approved the founding conditions.

PSBR 2 – Abutments and Piers

General

Bridge abutments and piers shall be constructed in reinforced concrete and shall be capable of supporting all dead loads, live loads, hydraulic loads and impact forces imposed by the bridge structure.

Construction

Abutments and piers shall be constructed to the dimensions and levels indicated on the Drawings.

Concrete shall comply with the Structural Concrete Specification and shall generally not be less than Grade 35 MPa unless otherwise specified.

Reinforcement shall comply with SANS 920 and shall be fixed accurately to maintain the specified cover.

Formwork

Formwork shall be designed to withstand all loads imposed during construction and shall produce the specified concrete surface finish.

Visible surfaces shall generally achieve a Class F3 finish unless otherwise specified.

Backfilling Behind Abutments

Backfill behind abutments shall consist of approved free-draining selected material compacted to not less than 95% Modified AASHTO density.

Adequate drainage measures shall be provided behind all abutments to prevent the build-up of hydrostatic pressure.

Tolerances

Completed abutments and piers shall comply with the dimensional tolerances specified in the Contract Documents.

PSBR 3 – Reinforced Concrete Decks

General

Bridge decks shall consist of cast in situ or precast reinforced concrete designed to safely carry all imposed traffic, maintenance and operational loads throughout the design life of the structure.

Concrete

Concrete used in bridge decks shall generally be Grade 40 MPa or higher as specified on the Drawings.

The concrete shall:

- Be durable;

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- Exhibit low permeability;
- Resist cracking;
- Be suitable for exposure conditions.

Reinforcement

Reinforcement shall be accurately fixed and securely supported to maintain the specified concrete cover during construction.

All reinforcement shall be inspected and approved before concrete placement.

Deck Construction

The Contractor shall ensure that:

- Deck levels are accurately maintained;
- Concrete is placed continuously where practical;
- Proper vibration is achieved;
- Cold joints are avoided;
- Surface tolerances are achieved.

Deck Finish

The deck surface shall provide adequate skid resistance and shall be finished in accordance with the requirements shown on the Drawings.

Curing

Concrete shall be cured continuously for not less than seven days or as specified by the Engineer.

PSBR 4 – Structural Steel Components

General

Structural steel components shall include all steel members required for the bridge structure, including girders, diaphragms, bracing systems, handrails, maintenance platforms, access structures and ancillary steelwork.

Materials

Structural steel shall comply with:

- SANS 50025;
- SANS 2001;
- Relevant structural steel standards.

Unless otherwise specified, steel shall be Grade S355 or approved equivalent.

Fabrication

Fabrication shall be undertaken by experienced steel fabricators in accordance with approved shop drawings.

All cutting, drilling, welding and fabrication shall comply with recognised structural steel fabrication standards.

Welding

Welding shall be undertaken by qualified welders using approved welding procedures.

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All welds shall be subject to visual inspection and non-destructive testing where specified.

Corrosion Protection

All exposed steelwork shall be protected against corrosion by:

- Hot-dip galvanising;
- Metallising;
- Protective coating systems;
- Multi-coat paint systems;

as specified on the Drawings.

Erection

Steel members shall be erected using approved methods that prevent distortion, overstressing or damage.

Temporary bracing shall be provided as necessary during erection.

PSBR 5 – Bearings and Expansion Joints

Bridge Bearings

Bridge bearings shall accommodate:

- Vertical loads;
- Horizontal loads;
- Rotational movement;
- Thermal movement;
- Shrinkage and creep effects.

Bearings shall comply with BS EN 1337 or approved equivalent standards.

Elastomeric Bearings

Elastomeric bearings shall be manufactured from natural or synthetic rubber and shall comply with the specified hardness, load capacity and movement requirements.

Installation

Bearings shall be installed:

- At the correct position;
- At the specified level;
- On approved mortar bedding;
- In accordance with manufacturer recommendations.

Bearing seating surfaces shall be level and free from irregularities.

Expansion Joints

Expansion joints shall accommodate all anticipated movements without loss of structural integrity or watertightness.

Expansion joints shall:

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- Prevent ingress of water;
- Resist traffic loading;
- Remain serviceable throughout the design life.

All joint materials, sealants and fillers shall be approved by the Engineer.

PSBR 6 – Parapets and Safety Barriers

General

Parapets and safety barriers shall be provided to ensure the safety of road users, pedestrians, maintenance personnel and the public.

Concrete Parapets

Concrete parapets shall be reinforced concrete structures constructed to the dimensions shown on the Drawings.

Concrete shall comply with the Structural Concrete Specification.

Steel Barriers

Steel barriers shall comply with approved road safety barrier standards and shall be capable of resisting vehicle impact loads.

All steel components shall be galvanised or otherwise protected against corrosion.

Handrails

Pedestrian handrails shall:

- Be securely fixed;
- Be free from sharp edges;
- Be corrosion resistant;
- Comply with applicable safety standards.

Tolerances

Completed parapets and barriers shall be true to line and level and shall present a neat appearance.

PSBR 7 – Approach Slabs

General

Approach slabs shall be provided at bridge abutments to minimise differential settlement and provide a smooth transition between the roadway embankment and bridge deck.

Materials

Approach slabs shall consist of reinforced concrete constructed using concrete not less than Grade 30 MPa unless otherwise specified.

Foundation Preparation

The founding surface beneath the approach slab shall be:

- Properly compacted;
- Free of soft spots;

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- Approved by the Engineer.

Any unsuitable material shall be removed and replaced with approved selected fill.

Reinforcement

Reinforcement shall be placed in accordance with the Drawings and securely fixed to prevent movement during concreting.

Backfill Requirements

Backfill beneath and adjacent to approach slabs shall consist of selected granular material compacted to not less than 95% Modified AASHTO density.

Surface Finish

The finished approach slab shall align smoothly with the bridge deck and adjoining roadway surface, with no abrupt changes in level.

Drainage

Adequate drainage shall be provided around approach slabs to prevent water accumulation, erosion and loss of support.

Scour Protection using Gabions and Reno Mattresses

Gabions and Reno mattresses used for scour protection shall comply with the requirements of SANS 1200 DK and shall be of the dimensions indicated on the project drawings and item 8.2.2 in the pricing data.

The Gabions and reno mattresses shall:

- Be manufactured from double twisted galvanized steel wire mesh;
- Be PVC coated where specified on the drawings;
- Be installed in accordance with the manufacturer's recommendations and SANS 1200 DK.

Stone Fill:

The stone fill used for filling the gabions and reno mattresses shall comply with SANS 1200 DK.

The stones shall:

- Be clean, hard durable and unweathered;
- Be free from cracks, fissures, clay and organic matter;
- Be of a size suitable for the specified mesh and basket depth.

Geotextile:

Geotextiles shall be installed beneath the gabions and reno mattress protection unless otherwise stated on the drawings and as per item 8.2.4 in the pricing data:

The geotextile shall:

- Comply with the requirements specified on the Drawings;
- Be placed on a prepared surface free from sharp objects and protrusions;
- Be installed with a minimum overlap of 300 mm;
- Be secured to prevent movement during construction.

All completed scour protection works shall be inspected and approved by the Engineer prior to acceptance.

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ME: MECHANICAL SPECIFICATION

MER A: MECHANICAL SPECIFICATION

1. SCOPE OF WORKS: RAW WATER ABSTRACTION PUMP STATION

This specification covers the mechanical works for the Abstraction Water Pump Station sourcing raw water from the Intake Tower and supplying the raw water to:

- Methula Water Treatment Works through an 8.113km pipeline with a 250mm Diameter at a head of 213.411m with a PN25 pressure rating.
- Mayflower Water Treatment Works through a 12.050km pipeline with a 315mm Diameter at a head of 81.634m with a PN25 pressure rating.

The work includes the supply, installation, testing and commissioning of two independent pump sets, each comprising three pumps operating in a 2 Duty / 1 Standby configuration, complete with pipework, valves, fittings, supports and all associated mechanical equipment required for a fully operational installation.

1.2. APPLICABLE STANDARDS

All equipment and materials shall comply with the latest applicable SANS/ISO standards, including but not limited to:

- SANS 10252 – Water supply and drainage
- SANS 1200 – Standardized specifications for civil engineering construction
- SANS 1091 – Hot dip galvanizing
- SANS 121 – Epoxy coatings
- SANS/ISO 9906 – Rotodynamic pump acceptance tests
- SANS 664 – Ductile iron pipes and fittings
- SANS 1808 – Elastomeric seals
- SANS 347 – Steel pipes and fittings

Note: Where conflicts occur, the more stringent requirement shall apply.

1.3. PUMP CONFIGURATION AND PHILOSOPHY

Design, supply, installation, testing and commissioning of Grundfos CRN vertical multistage centrifugal pumps for high-head raw water transfer from the Abstraction Pump Station to Methula and Mayflower Water Treatment Works.

Each pump shall be capable of delivering up to 350 m³/h against a total dynamic head of up to 200 m. Pumps shall operate under VSD control in a duty/standby configuration.

Grundfos CRN series vertical in-line multistage centrifugal pump with stainless steel wetted parts for raw water duty is recommended for this operation.

1.3.1 HYDRAULIC REQUIREMENTS

Pump selection from CRN64 or CRN90 range with sufficient stages to achieve the specified duty.

Parameter

Requirement

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Maximum Flow	350 m ³ /h
Total Dynamic Head	200 m
Liquid	Raw untreated water
Temperature	5 – 35 °C
Efficiency	>75% at duty
NPSH Margin	Minimum 1 m above NPSH _r

1.3.2 PUMP CONSTRUCTION

Construction materials:

Component	Material
Pump head & base	Cast iron epoxy coated
Wetted parts	Stainless steel AISI 316
Shaft	Stainless steel
Wear rings	Stainless steel
Fasteners	Stainless steel
Coupling guard	Stainless steel

1.3.3 MECHANICAL SEAL

Grundfos cartridge mechanical seal, seal code HQQE/HQQV (SiC/SiC), suitable for raw water.

1.3.4 MOTOR REQUIREMENTS

Motor specification:

Parameter	Requirement
Type	IEC TEFC squirrel cage
Power	90 – 260 kW (selection dependent)
Voltage	400 V, 50 Hz, 3-phase
Protection	IP55
Insulation	Class F
Efficiency	IE3 minimum
Speed	2900 rpm

Two separate pump sets shall be provided wherein each set will consist of 3 Grundfos Multistage vertical Pumps:

Pump Set A → Mayflower WTW:

- Required Flow rate: **576m³/h** (combined flow)
- Total Dynamic Head: **81.634m**
- Motor Power: **120kW**

Pump Set B → Methula WTW:

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- Required Flow rate: **360m³/h** (combined flow)
- Total Dynamic Head: **213.411m**
- Motor Power: **180kW**

The operational philosophy will be arranged as:

- 2 Duty pumps operating simultaneously
- 1 Standby pump with automatic changeover based on run hours

The two pump sets shall operate independently.

1.4. PUMP PERFORMANCE AND CHARACTERISTICS CURVES

1.4.1 Pump Curve – OCSD to Mayflower Water Treatment Works

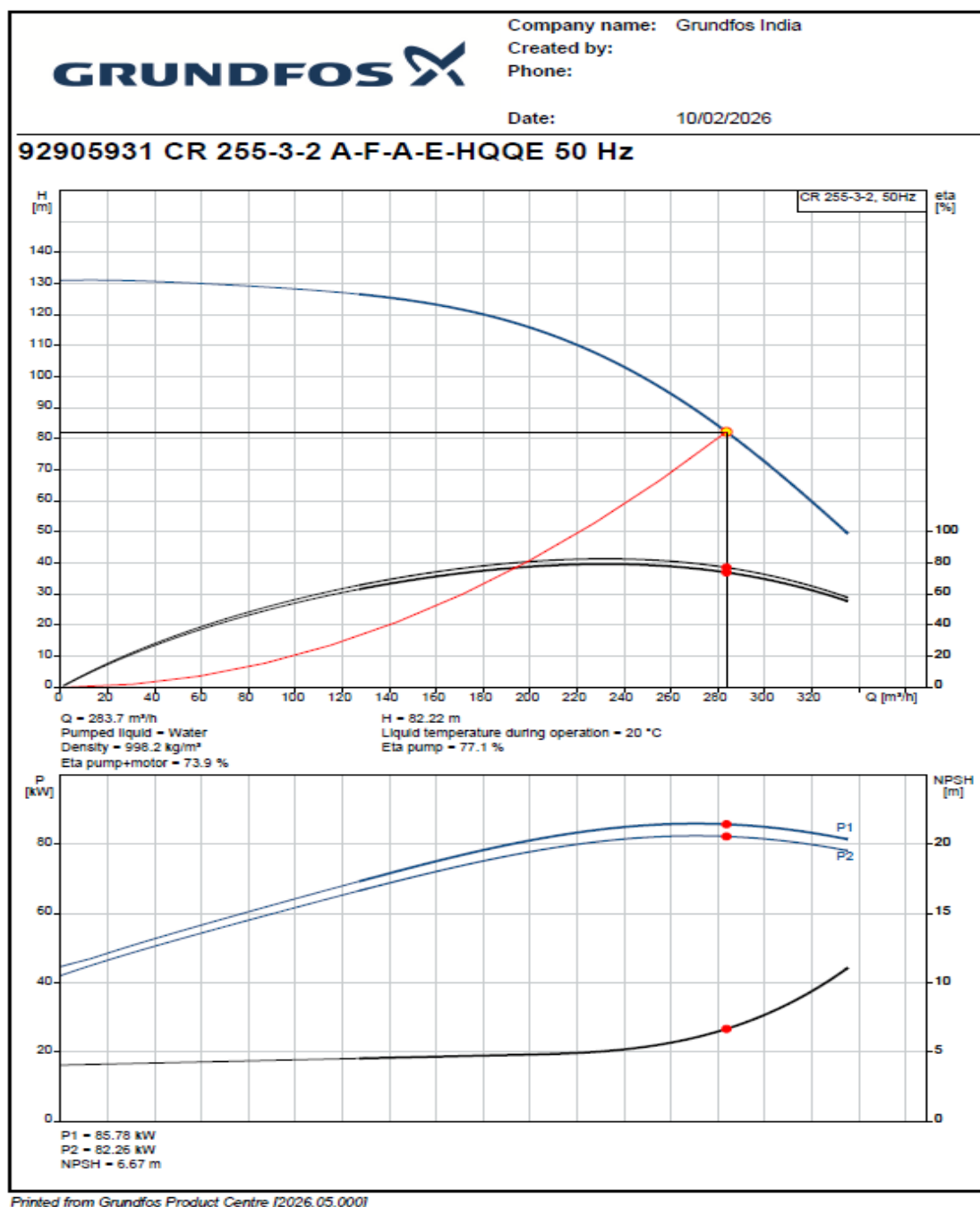


Figure 2: Pump Characteristic Performance Curve

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1.4.2 Pump Curve – OCSD to Methula Water Treatment Works

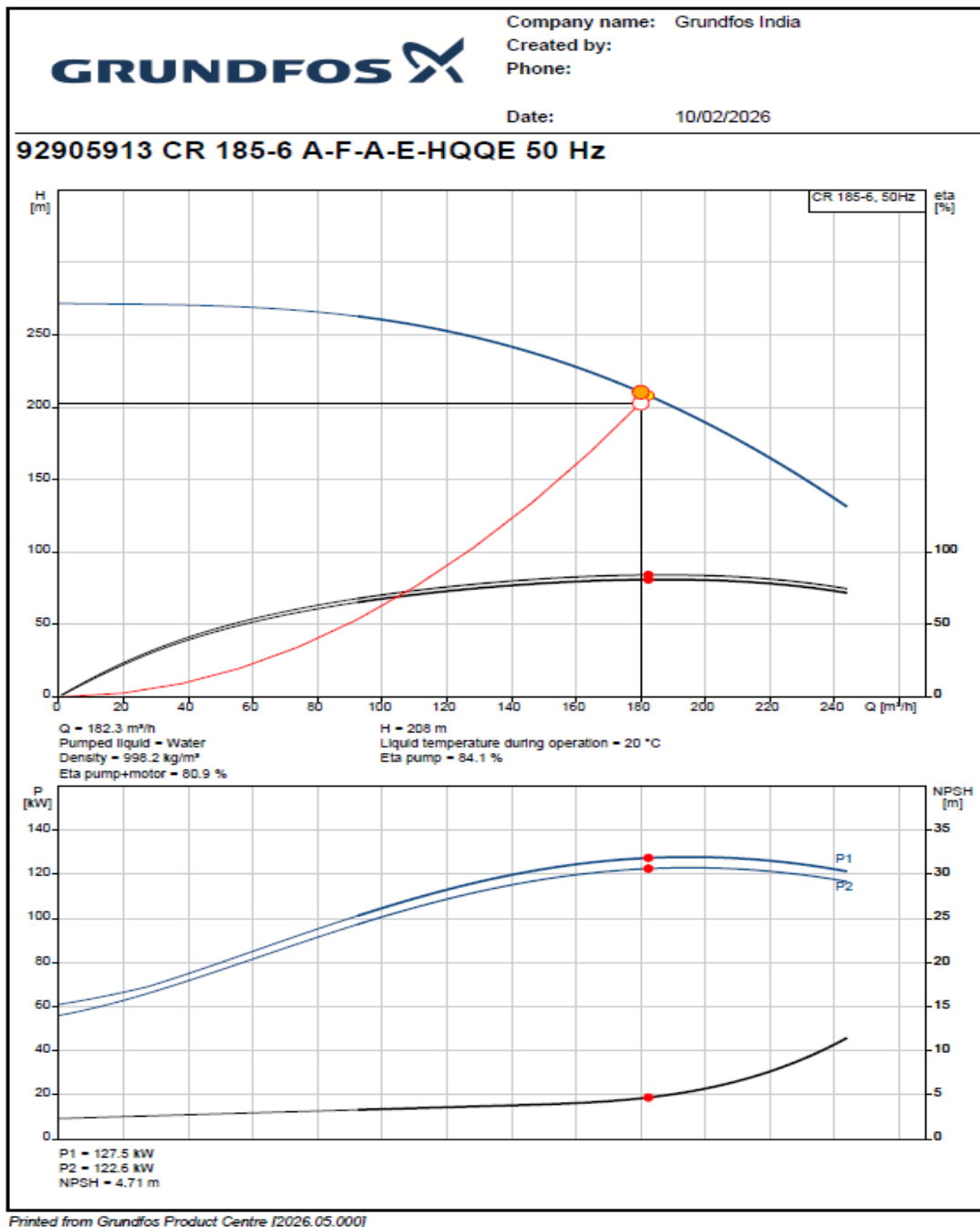


Figure 3: Pump Characteristic Performance Curve

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1.5. SUCTION AND DISCHARGE PIPEWORK SYSTEM

A common suction manifold shall be provided from the abstraction source with individual branches to each pump.

The following shall be provided:

- Eccentric (flat on top) and Concentric reducers
- Full bore isolation RSV Gate Valves
- Air release valves at high points
- Electromagnetic Flow meter with digital display stationed inside the pump house for measuring incoming flow
- Adequate straight lengths before pump suction

The design shall prevent cavitation, vortex formation and air entrainment.

Each pump discharge shall include a non-return valve, isolating valve, Bermad Control valve and dismantling joint prior to connecting into a common delivery manifold.

Separate rising mains shall feed Methula WTW and Mayflower WTW respectively and Electromagnetic Flow meters will be installed for each rising main and a digital display stationed in the pump station.

Pipework within the pump station shall be MSCL, as per design drawings. All joints within the station shall be flanged.

Fittings shall include long radius bends, reducers, tees and flange adaptors.

Reinforced concrete plinths shall be provided for pumps. Galvanized steel supports, anchors, guides and thrust restraints shall be installed to withstand operational and surge loads.

1.6 SURGE AND WATER HAMMER PROTECTION

Provision shall be made for surge protection measures including slow closing non-return valves, surge anticipation valves or air vessels where required and proper anchoring of pipework.

1.7 MONITORING DEVICES

Full detail of all monitoring devices offered must be submitted with the Tender.

PRESSURE GAUGES

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards.

These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

TEMPERATURE DETECTORS

If required oil lubricated bearings and glands offered shall be fitted with temperature detectors. The temperature detectors shall be PT100 – RTD's

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If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

NO-FLOW PROTECTION

Each pump shall be protected against no flow by a flow meter/ sensor installed in the discharge line from the pump.

INDICATOR ON AUTOMATIC AIR VENT

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

GLAND LEAKAGE

If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

1.8 PIPEWORK, MATERIALS & SIZING

All suction and delivery pipes shall be connected to the pump casing by means of flexible connections. All flexible connections shall be installed as close to the pump's casings as possible, and in any event, shall be between the suction valve and the pump casing and delivery non-return valve and the pump casing. In all cases the flexible connection shall be in the section of piping of smallest diameter.

Double Victaulic joint are generally preferred for flexible connections, but approved re-enforced rubber bellow units are acceptable for low-pressure services.

All valves and pipework external to the pump casing and separated there from by means of flexible connections shall be securely anchored to prevent movement.

1.8.1 Recommended velocities and pipe sizes

- Target discharge velocity: **1.2 – 2.5 m/s** (design near 1.5–2.0 m/s recommended for pump discharge). Suction velocity lower to minimize NPSH losses: **≤ 1.5 m/s**.
- For single combined discharge (90 L/s):
 - $Q = 0.09 \text{ m}^3/\text{s}$. At $v = 1.5 \text{ m/s} \Rightarrow \text{diameter} \approx 350 \text{ mm} \rightarrow \text{use } \mathbf{DN\ 315\ (315\ mm)}$ ductile iron or equivalent depending on layout and losses. Provide hydraulic check by Contractor.

Pipe material (potable): Ductile iron pipe to EN/ISO standards with bituminous or epoxy internal lining certified for potable water OR polyethylene (PE) PN rating per pressure class, or stainless steel for short runs. All materials must be certified potable-water safe. Any steel pipe buried underground must be wrapped with **3LPE**.

1.8.1 HOLDING DOWN BOLTS

The contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him/her. The holding down bolts shall be manufactured from 316 SS.

All bolts necessary for assembling all equipment shall be supplied by the contractor.

1.9 VIBRATION AND NOISE

The pumps as well as the motors will comply with the requirements of BS 4999. The Contractor may be requested by the Engineer to carry out vibration tests. The noise level shall not exceed 85 dBA at 1m.

1.10 DESIGNATION AND INFORMATION PLATES

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details: -

- ❖ Maker's name, pump type and serial number

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- ❖ Year of manufacture
- ❖ Rated duty of pump in litres per second
- ❖ Head in metres at rated duty
- ❖ Pump speed in r/min
- ❖ Mass of completely assembled pump in kilogram

1.10.1 INTERCHANGEABILITY

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

1.10.2 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

1.11 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final takeover of the plant. The Operation and Maintenance Manual will contain the following:

1. Brief description of the plant and installation.
2. Concise operating instructions.
3. Routine maintenance instruction.
4. Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
5. Detailed information on equipment.
6. Lists of spare parts including names and addresses of suppliers.

1.12 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

1.13 INSTALLATION

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, and pipework erected and tightened, both angular and parallel alignment shall be checked using a Laser Alignment Tool and recorded at each quarter revolution. These readings shall be submitted to the Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

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1.14 INSPECTION, TESTING AND COMMISSIONING

Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

1.15 WITNESSED TESTING

In addition to the above, a number of **Factory Acceptance Tests (FAT)** performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These FAT tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include: -

1. Hydraulic tests on the pump casing. The test pressure will be equal to 1½ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
2. Tests to prove that the rotating parts are dynamically balanced.
3. Performance tests on pump and driving unit.
4. NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

1.15.1 TESTING BY AN INDEPENDENT FACILITY

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected.

Should the pump unit still fail to pass the test, but the actual figures do not vary by more than

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5% from the actual guaranteed figures, the Engineer may:

1. Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
2. Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

1.16 COMMISSIONING

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

1.17 TESTS AT THE SITE OF THE WORKS

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

- **Hydrostatic test:** pipeline and valves at 1.5× maximum working pressure or as per local code.
- **Witnessed start-up & performance test:** confirm delivered flow ≥ 90 L/s at 200 m TDH (or system acceptance curve) with each pump (for 2× scheme) and confirm single pump capability per design. Measure actual flow with calibrated flowmeter and record head, power, efficiency. Acceptance tolerance $\pm 5\%$ or as defined by contract.
- **Vibration & noise:** measured against ISO standards; correct if exceed limits.
- **Electrical tests:** insulation, earthing continuity, motor rotations, VFD parameter verification.
- **Functional test:** automatic control sequences, alarms, remote SCADA comms, duty change-over test.
- Hydrostatic testing, pump alignment, vibration testing and full performance testing shall be carried out prior to handover.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 – re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

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Should the subsequent test results still fall outside the allowable tolerances costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the employer.

1.18 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance determined by the contractor and be fully defined.

1.19 CORROSION PROTECTION

All steel pipework and fittings shall be blast cleaned to SA 2½ and epoxy coated internally and externally in accordance with SANS 121. Exposed fasteners shall be stainless steel. Buried pipes shall be wrapped with Denso tape.

1.20. IDENTIFICATION AND LABELLING

All pipework shall be marked with flow direction arrows. Valves and pumps shall have identification tags. Rising mains shall be clearly marked for Methula and Mayflower WTWs.

1.21 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete installation as specified, electrical connections, etc. and grouting, etc. Measurement and payment will distinguish between supply / delivery and installation / commissioning of the equipment.

The tendered rates or sums shall cover the cost of design, drawings, manufacture, supply, testing at the manufacturers works, delivery to site, offloading, installation, site testing, setting into operation, the supply of O & M manuals, commissioning and maintenance during the warranty period of all equipment specified and also for anything not specifically mentioned but obviously required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material required for the proper installation of such equipment) to enable the equipment to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned.

Appendix A

DATA SHEET FOR THE PUMP SETS 1

ITEM	DESCRIPTION
Pump Make	
Pump Model	
Head (m)	184.44
Flow Rate	180m³/h
Motor Rating (kW)	
Efficiency (%)	
Number of Stages	Multi Stage
Shaft Seal	
Impeller Material	
Stage casing	
Shaft Material	

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Spacer Sleeve	
Painting	

DATA SHEET FOR THE PUMP SETS 2

ITEM	DESCRIPTION
Pump Make	
Pump Model	
Head (m)	74.7
Flow Rate	288m ³ /h
Motor Rating (kW)	
Efficiency (%)	
Number of Stages	Multi Stage
Shaft Seal	
Impeller Material	
Stage casing	
Shaft Material	
Spacer Sleeve	
Painting	

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MER B: WATER INTAKE TOWER AND 600 mm RAW WATER PIPELINE SUPPLY TO ABSTRACTION PUMP STATION

This specification covers the design, supply, manufacture, delivery, installation, testing and commissioning of the complete mechanical works for the raw water intake tower, four-level intake system, and 600 mm diameter raw water pipeline supplying the abstraction pump station.

The works shall include intake screens, isolation gates valves, internal manifold pipework, access platforms, lifting equipment, corrosion protection, valves, fittings, and all associated mechanical components required for a fully functional intake system.

2.1 APPLICABLE STANDARDS

All materials and equipment shall comply with the latest applicable editions of the following standards:

- SANS 1200 & SANS 2001 – Civil and Mechanical interfaces
- SANS 664 – Ductile iron pipes
- SANS 719 – Steel pipes for water
- SANS 1217 – Isolation valves
- SANS 1984 – Protective coatings for steel water pipes
- ISO 12944 – Corrosion protection
- BS EN 1092 – Flanges
- EN 1074 / BS 5155 – Valves for waterworks
- AWWA C200 & C205 – Steel water pipe and linings

2.2 SYSTEM DESCRIPTION

The intake tower shall be constructed within the dam and shall incorporate four vertically spaced intake ports allowing selective abstraction of water based on quality and dam level.

Each intake port shall discharge into a common 600 mm manifold connected to a 600 mm pipeline delivering water to the abstraction pump station.

2.3 INTAKE LEVEL ARRANGEMENT

The intake structure shall provide four selectable intake levels as follows:

- Level 1 – High water level abstraction
- Level 2 – Mid-high-level abstraction
- Level 3 – Mid-low-level abstraction
- Level 4 – Low water / emergency abstraction

Each level shall be independently isolatable by means of a sluice gate or gate valve.

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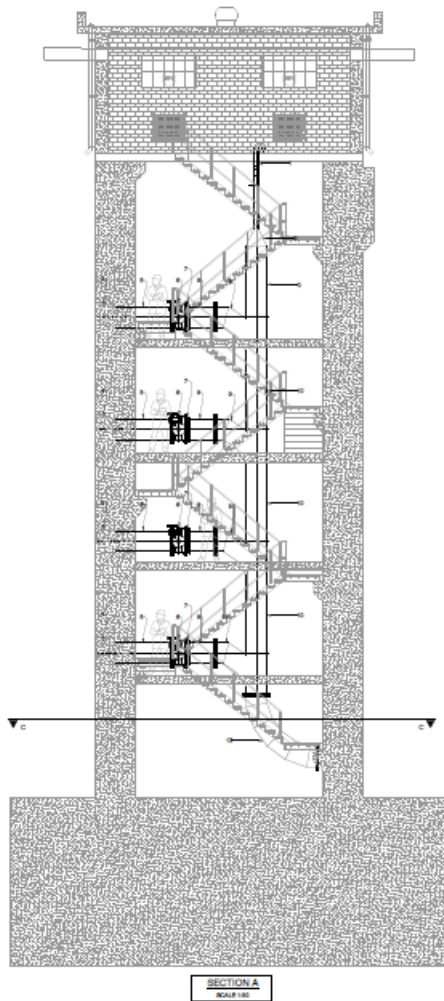


Figure 4: Intake Tower depicting the multiple intake ports

Intake screens (trash racks) shall be installed at each intake port. Screens shall be manufactured from Grade 316 stainless steel with bar spacing between 50 mm and 75 mm. Screens shall be removable, guide-rail mounted, and suitable for manual or mechanical cleaning. Maximum velocity through the screen shall not exceed 0.3 m/s.

Each intake level/ port shall be provided with a 600 mm epoxy coated ductile iron gate or butterfly valve suitable for full dam hydrostatic head.

The valves shall be Actuator operated and accessible to the operating platform and shall include position indicators. The valve operation philosophy shall be such that the water level at highest in take port will trigger the below intake valve to move into **OPEN POSITION**.

The manifold inside the tower shall be 600 mm diameter mild steel pipe to AWWA C200 with fusion bonded epoxy or cement mortar lining and external epoxy coating to ISO 12944 C5-M.

Dismantling joints shall be provided to facilitate maintenance.

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2.4 THE 600 mm RAW WATER PIPELINE TO PUMP STATION

The pipeline shall be 600 mm diameter mild steel or ductile iron, PN16 minimum, cement mortar or FBE lined with external epoxy or polyethylene coating.

Air release valves, scour valves, dismantling joints and an isolation butterfly valve shall be provided as required along the route.

2.5 ACCESS PLATFORMS AND LIFTING EQUIPMENT

Hot dip galvanized access platforms, stainless steel ladders, and a davit arm or monorail beam shall be provided for maintenance of screens and valves.

Fall arrest systems shall be included.

2.6 CORROSION PROTECTION

All submerged steel shall be epoxy coated for marine environments. Stainless steel shall be used for screens, guides and ladders. Galvanizing shall be applied to access platforms. Sacrificial anodes shall be provided where specified.

2.7 INSTALLATION REQUIREMENTS

All equipment shall be installed true to line and level. Flanged joints shall use EPDM gaskets. All supports shall be securely anchored to the civil structure. Diver-assisted installation procedures shall be allowed where necessary.

2.8 TESTING AND COMMISSIONING

Hydrostatic testing of the 600 mm pipeline, operational testing of gates and valves, and full functional testing with the abstraction pump station shall be conducted.

2.9 DOCUMENTATION

The Contractor shall provide shop drawings, as-built drawings, coating certificates, valve schedules and full operation and maintenance manuals.

MER C: SUMP PUMP SYSTEM FOR FLOOD PROTECTION

This section covers the design, supply, installation, testing and commissioning of a submersible sump pump system for removal of flood water from pump station wet wells, dry wells, valve chambers or basement areas in the event of flooding, pipe burst, leakage or seepage.

The sump pump system shall protect critical equipment from flood damage, operate automatically during unattended conditions, and provide alarm indication to the control system.

3.1. APPLICABLE STANDARDS

The installation shall comply with SANS 10252, SANS 10142, SANS 1200, SANS 121 / ISO 1461 and relevant OEM standards.

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3.2. SUMP PIT REQUIREMENTS

Where not existing, the Contractor shall construct a reinforced concrete sump pit as follows:

Item	Requirement
Minimum size	1000 x 1000 x 1000 mm deep
Material	Reinforced concrete, waterproofed
Floor	Sloped toward sump
Cover	Chequered plate or grating, removable
Inlet	Floor channels directing water to sump
Access	Safe access for maintenance

3.3. SUMP PUMP REQUIREMENTS

The pump shall be a vertical submersible type suitable for dirty water and minor solids.

Parameter	Requirement
Minimum flow rate	10 – 30 m ³ /h
Minimum head	10 – 25 m
Solids handling	Minimum 10 mm passage
Motor rating	1.1 – 2.2 kW
Voltage	400V, 3-phase
Protection	IP68
Insulation	Class F
Cable length	Minimum 10 m

3.4. PUMP INSTALLATION

The pump shall be installed on a stainless-steel guide rail system with duck foot bend discharge connection and stainless-steel lifting chain for safe removal.

3.5. DISCHARGE PIPEWORK

The discharge pipework shall comply with the following:

Item	Specification
Pipe material	HDPE / Galvanized steel / Stainless steel
Diameter	Minimum DN50
Non-return valve	Swing or spring type
Isolation valve	Lever operated ball valve
Discharge point	Stormwater drain outside building

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Galvanized brackets

The pump shall operate automatically using three float switches for ON level, OFF level and High-level alarm.

3.7. CORROSION PROTECTION

3.8. TESTING AND COMMISSIONING

3.9. MAINTENANCE REQUIREMENTS

MER D. VENTILATION SYSTEM

- The below-ground pump station (6 m below natural ground level), and
- The above-ground electrical building housing MCCs, VSDs, PLC panels and instrumentation.

All works shall comply with the Occupational Health and Safety Act and relevant SANS standards.

Pump Station (Below Ground):

- ### Electrical Building (Above Ground):

- ## 4.2. CODES AND STANDARDS

- SANS 10400-O — Ventilation

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- SANS 10083 — Measurement and control of ventilation
- SANS 10142 — Electrical installation
- ISO 5801 — Fan performance testing
- Occupational Health and Safety Act requirements for confined spaces

4.3. VENTILATION PHILOSOPHY

Pump Station:

A forced fresh air supply and forced extraction system shall be provided. Fresh air shall be forced to the lowest level of the pump chamber and extraction shall occur at high level to remove humid and contaminated air. The system shall create slight positive pressure.

Electrical Building:

A forced intake and extraction system with filtration shall maintain internal temperature below 35 °C. Fans shall be thermostat controlled.

4.4. AIR FLOW REQUIREMENTS

Pump Chamber:

Assumed volume: Approximately 660 m³

Required airflow: Minimum 12 000 m³/h

Electrical Room:

Assumed volume: 330 m³

Required airflow: Minimum 2 500 m³/h

The Contractor shall verify actual dimensions and recalculate if required.

4.5. EQUIPMENT REQUIREMENTS

Fans – Pump Station:

- Axial flow industrial fans
- Capacity: 12 000 m³/h (minimum)
- IP65, corrosion class C5-M
- TEFC motors, Class F insulation
- Anti-vibration mounting

Ducting:

- Galvanized steel sheet
- Sized for air velocity < 8 m/s
- Stainless steel supports

Louvers:

- Weatherproof galvanized steel with bird and insect mesh

Electrical Room Fans:

- Wall mounted extraction fan or roof mounted whirly bird
- Filtered intake louver
- Replaceable G4 filters

4.6. CONTROL AND INSTRUMENTATION

Provide fixed gas detection for methane, hydrogen sulphide and oxygen levels in the pump chamber. System shall be linked to alarms, PLC and fan boost mode.

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Electrical room fans shall be thermostat controlled with local HOA override and status indication to SCADA.

4.7. ELECTRICAL REQUIREMENTS

Fans shall be fed from the MCC with dedicated breakers and local isolators. Wiring shall be corrosion resistant and connected to the standby generator supply.

4.8. INSTALLATION REQUIREMENTS

Ducting shall not obstruct pump removal routes. All penetrations shall be sealed watertight. Flexible joints shall be installed at fans and access panels provided for maintenance.

4.9. TESTING AND COMMISSIONING

The Contractor shall demonstrate measured airflow rates, gas detector calibration, thermostat operation, acceptable noise levels and air change verification using smoke testing.

4.10. MEASUREMENT AND PAYMENT

The ventilation system shall be measured as a complete installed and commissioned system including all ducting, controls, cabling, sensors and accessories.

4.11. GUARANTEES

The Contractor shall guarantee achievement of specified air changes, corrosion resistance for five years and availability of spares for ten years.

MER E: BOLTS, NUTS AND FASTENERS SPECIFICATION

5.1. SCOPE

This section covers the supply, material, coating, installation, and protection requirements for **bolts, nuts, studs, washers, anchor bolts, and threaded fasteners** used in the construction of potable water pump stations, including pumps, pipework, valves, flow meters, flanges, supports, and appurtenances.

5.2. GENERAL REQUIREMENTS

- All bolts, nuts, and washers shall be **high-quality, corrosion-resistant**, and **certified for use in potable (drinking) water applications**.
- Fasteners shall be selected to suit the **service environment** (wet, submerged, buried, or dry indoor).
- All materials shall be **non-toxic** and **non-leaching** under potable water conditions.
- Where dissimilar metals are in contact, appropriate insulation (nylon washers, sleeves, or barrier coatings) shall be used to prevent galvanic corrosion.

5.3. Materials and Grades

Application	Material	Standard	Notes
General above-ground / dry indoor service	Stainless Steel A2 (Type 304)	ISO 3506-1 (A2-70) or ASTM F593	Use where condensation but no direct water contact.
In contact with potable water, submerged, or buried service	Stainless Steel A4 (Type 316 / 316L)	ISO 3506-1 (A4-70 or A4-80) or ASTM F593 Type 316	Fully potable-water safe, highly corrosion resistant.
Anchor bolts embedded in concrete	Hot-dip galvanized mild steel (min. 85 µm coating) or stainless steel 316	ASTM A307 Grade B or equivalent	Stainless preferred in wet areas.
Flange bolts/nuts	Stainless Steel A4-70 (316)	ISO 3506-1	Ensure full nut engagement; use potable-approved lubricant.
Valve fasteners (non-wetted)	Carbon steel zinc-plated or stainless steel A2	ISO 898-1 (8.8) or ISO 3506-1 (A2-70)	Only if not exposed to water; otherwise use A4.

5.4. SURFACE TREATMENT & COATING

- **Stainless steel** bolts and nuts: *no coating required*; must be clean and free from iron contamination.

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- **Hot-dip galvanized** bolts: coating thickness $\geq 85 \mu\text{m}$ (ASTM A153 / ISO 1461).
- **Zinc-plated or sherardized** bolts are **not permitted** in submerged or continuously wet potable water areas due to risk of leaching and corrosion.
- **Epoxy-coated or nylon-coated** fasteners may be accepted for buried service if potable-water certified (NSF 61 or local equivalent).

5.5. WASHERS AND GASKETS

- **Washers** shall be of the **same material** as bolts/nuts (e.g., stainless steel A4).
- Use **flat washers** under both bolt head and nut to avoid damage to flange coatings.
- For insulated joints or dissimilar metals, use **nylon or PTFE insulating washers/sleeves** as specified.
- **Rubber or elastomeric washers** in contact with potable water must be **EPDM, WRAS, or NSF 61 approved**.

5.6. LUBRICATION & ANTI-SEIZE COMPOUNDS

- All stainless-steel threads shall be coated with a **potable-water-approved anti-seize compound** to prevent galling and seizing.
- Acceptable products: nickel-based or PTFE-based anti-seize pastes certified for potable water (e.g., **Molykote 111**, **Loctite 248**, or equivalent NSF/WRAS approved).
- Petroleum-based or copper-based greases are **not permitted** on potable water contacting surfaces.

5.7. INSTALLATION REQUIREMENTS

- Bolts shall project **one full thread beyond the nut** after tightening.
- Use **torque tightening** to manufacturer's recommended torque values; ensure uniform tightening using star pattern on flanges.
- Do **not reuse** bolts or nuts that show corrosion, thread damage, or deformation.
- **Field cutting or welding** of bolts is prohibited unless approved.
- Protect all exposed threads (outdoors or in wet wells) with corrosion-inhibiting caps or wraps.

5.8. IDENTIFICATION AND CERTIFICATION

- Manufacturer to provide **material certificates (EN 10204 3.1)** for all fasteners used in potable water applications.
- Certification shall confirm:
 - Material composition and grade (chemical analysis),
 - Mechanical properties,
 - Compliance with potable-water safety standards (e.g., **NSF/ANSI 61, WRAS, or SABS potable approval**).
- Each fastener package must be clearly labelled with size, grade, and material.

5.9. TYPICAL BOLT GRADES AND STRENGTHS

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Designation	Material	Tensile Strength (MPa)	Yield Strength (MPa)	Common Use
A2-70	Stainless Steel 304	700	450	General indoor fasteners
A4-70	Stainless Steel 316	700	450	Potable water, submerged use
A4-80	Stainless Steel 316	800	600	High-strength potable water service
8.8 Galvanized	Carbon steel, zinc or HDG	800	640	Structural/anchor bolts (dry areas)

5.10. TORQUE TIGHTENING GUIDANCE (FOR STAINLESS STEEL BOLTS)

(Indicative – verify per manufacturer and gasket type)

Bolt Size	Recommended Torque (A4-70, Nm)	Flange Type
M12	50–60	PN10–PN16 flanges
M16	100–120	PN10–PN16 flanges
M20	180–200	PN16–PN25 flanges
M24	300–350	PN25 flanges
M30	500–600	High pressure applications

(Note: Values assume lubricated threads with potable-approved anti-seize. Adjust for gasket compression requirements.)

5.11. STORAGE AND HANDLING

- Fasteners shall be stored in **dry, covered** conditions away from chemicals or chlorinated water vapours.
- Stainless steel bolts shall be segregated from carbon steel fasteners to prevent cross-contamination and corrosion.
- Use clean gloves when handling to prevent contamination.
- Replace any corroded or contaminated bolts before installation.

5.12. APPLICATION SUMMARY TABLE

Location / Application	Recommended Material	Surface Finish	Notes
Pump discharge flanges	SS A4-70 (316)	Polished, uncoated	Potable-water compatible
Flow meter & valve flanges	SS A4-70	None	Use potable anti-seize
Anchor bolts (dry floor)	HDG 8.8	≥85 µm galvanizing	Protect exposed ends
Anchor bolts (wet area / sump)	SS 316	None	Prefer full stainless
Pipe supports (dry indoor)	Carbon steel / galvanized	≥85 µm galvanizing	Not in water contact
Access covers / hatches	SS 304 or 316	None	As per corrosion exposure
Buried connections	SS 316 or HDG	Epoxy or bituminous coat	Must resist soil moisture

5.13. STANDARDS AND REFERENCES

Fasteners shall comply with one or more of the following standards (latest revisions):

- ISO 3506** – Mechanical properties of corrosion-resistant stainless-steel fasteners
- ISO 898** – Mechanical properties of carbon steel fasteners
- EN 1092 / EN 1514** – Flanges and gasket interfaces

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- **ASTM F593 / F594** – Stainless steel bolts, nuts, and studs
- **ASTM A193 / A194** – Alloy and stainless-steel bolting for high temperature or pressure
- **NSF/ANSI 61** – Drinking Water System Components – Health Effects
- **WRAS / SABS** – Potable water approval standards for materials in contact with drinking water

MER F: ELECTROMAGNETIC FLOW METER SPECIFICATION

(For Potable Water Pump Station Applications)

6.1. GENERAL DESCRIPTION

This specification covers the design, manufacture, supply, calibration, and testing of **electromagnetic flow meters** for the measurement of potable water flow in a pump station discharge or pipeline system.

Meters shall provide **accurate, repeatable, and maintenance-free** measurement of the flow rate and totalized volume, with electronic transmitter outputs compatible with the plant's **SCADA and PLC control system**.

All materials and components in contact with water shall be **certified for potable water use** (e.g., **WRAS, NSF/ANSI 61**, or **SABS potable-water approval**).

6.2. SERVICE CONDITIONS

Parameter	Specification
Medium	Potable water
Flow range	0 – 1.2 × design flow (typical design flow = 90 L/s)
Flow rate	90 L/s (324 m³/h nominal)
Fluid temperature	0 – 40 °C
Operating pressure	Up to 16 bar (PN16) or as system design
Accuracy requirement	±0.5% of reading (±0.2% optional high accuracy)
Repeatability	Better than ±0.1%
Power supply	230 VAC ±10%, 50 Hz or 24 VDC (as specified)
Output signals	4–20 mA Analog, pulse, and digital (Modbus RS485 / Ethernet)
Installation	Horizontal or vertical, full pipe condition required
IP Rating	≥ IP68 (submersible) for sensor; IP65 or higher for transmitter

6.3. TYPE AND CONSTRUCTION

- **Type:** Full-bore **electromagnetic flow meter**, designed for **bidirectional** flow measurement.
- **Measuring principle:** Faraday's law of electromagnetic induction.
- **Design:** Separate sensor (flow tube) and transmitter, or integrated compact type where space allows.
- **Mounting:** Flanged to suit pipework (EN 1092-1 / ISO 7005 / ANSI B16.5).
- **Nominal diameters:** To suit discharge line sizes (DN200–DN300 typical).

6.4. MATERIALS OF CONSTRUCTION

Component	Material	Requirements
Flow tube body	Stainless steel (304 or 316) or epoxy-coated carbon steel	Internally lined; corrosion-resistant
Liner	Hard rubber (EPDM), PTFE, or polyurethane	Potable-water certified (WRAS, NSF)
Electrodes	316L stainless steel or Hastelloy C / Titanium	Resistant to corrosion and scaling
Gaskets	EPDM potable-water approved	WRAS/NSF compliant
Bolts & nuts	Stainless steel A4-70 (316)	Per fastener spec
Transmitter housing	Die-cast Aluminium, epoxy powder coated, or stainless steel	IP65 minimum, IP68 for field mounting

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Component	Material	Requirements
Cable glands	Nickel-plated brass or stainless steel	IP68 rated
Paint/coating	Non-toxic epoxy, potable-water approved	No lead or heavy metals

6.5. FUNCTIONAL REQUIREMENTS

- **Accuracy:** $\pm 0.5\%$ of measured value ($\pm 0.2\%$ for premium models).
- **Repeatability:** $\pm 0.1\%$.
- **Flow direction:** Bidirectional measurement with automatic direction indication.
- **Minimum conductivity:** $\leq 5 \mu\text{S/cm}$ (suitable for potable water).
- **Zero stability:** Automatic or manual zero adjustment.
- **Response time:** Configurable, typically $< 1 \text{ s}$.
- **Empty pipe detection:** Integral detection with alarm output.
- **Self-diagnostics:** Internal diagnostics for coil, electrode, and electronics faults.
- **Totalizer:** Forward, reverse, and net totalizers with reset and non-volatile memory.
- **Display:** Backlit LCD showing instantaneous flow, total flow, alarm status, and diagnostics.
- **Communication Protocols:**
 - Analog: 4–20 mA isolated output (active or passive)
 - Digital: Modbus RTU (RS485), HART, or Ethernet (Modbus TCP/IP) as per system design
 - Pulse/frequency output: programmable for totalizing
- **Integration:** Fully compatible with SCADA/PLC systems.

6.6. INSTALLATION REQUIREMENTS

- Install in a **full-bore, continuously full pipeline**.
- Provide **straight lengths** upstream and downstream as per manufacturer's recommendations:
 - $\geq 5 \times \text{DN}$ upstream ($10 \times \text{DN}$ preferred if upstream valve/elbow),
 - $\geq 3 \times \text{DN}$ downstream.
- Flow direction clearly indicated on body.
- Mount electrodes horizontally to avoid air entrapment.
- Provide earthing rings or grounding electrodes if required (especially with plastic pipes).
- Install isolation valves upstream and downstream for maintenance.
- Avoid installation close to strong magnetic fields or electrical cables.

6.7. ELECTRICAL AND SIGNAL WIRING

- Power and signal cables shall be in **separate screened conduits**.
- Cable screens to be earthed at one end only (as per manufacturer's instructions).
- Provide cable glands rated **IP68** at field sensor.
- Connect transmitter to MCC/PLC using approved wiring diagrams.

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6.8. PROTECTION & ENVIRONMENTAL RATINGS

Component	Ingress Protection	Environmental
Flow sensor	IP68 (permanent immersion up to 10 m)	UV and corrosion resistant
Transmitter	IP65 minimum (indoor), IP67/IP68 (outdoor)	Ambient 0–55 °C
EMC Compliance	IEC/EN 61326	Immunity to electrical noise
Vibration	IEC 60068	Up to 2g, 10–1000 Hz

6.9. CALIBRATION AND TESTING

- Each flow meter shall be **factory-calibrated** on a traceable water calibration rig.
- Calibration shall be **traceable to national standards** (SANAS, NIST, or equivalent).
- Manufacturer shall supply **individual calibration certificates** for each meter showing serial number, test date, and results.
- Field verification capability via in-situ diagnostic or portable reference meter (if required).

6.10. MARKING AND NAMEPLATES

Each flow meter shall have a **stainless steel or engraved nameplate** showing at minimum:

- Manufacturer and model
- Serial number
- Nominal size and pressure rating
- Flow range and accuracy
- Liner and electrode materials
- Power supply and output details
- IP rating and certification marks

6.11. DOCUMENTATION AND SUBMITTALS

The supplier shall provide:

- Manufacturer's data sheets and drawings (dimensioned, showing flow direction).
- Electrical connection diagrams.
- Installation and operation manual (IOM).
- Factory calibration certificate.
- Potable-water compliance certificate (WRAS/NSF/SABS).
- Spare parts list and recommended maintenance schedule.

6.12. STANDARDS AND COMPLIANCE

Meters and components shall comply with the latest editions of:

- **ISO 6817 / EN 29104** – Electromagnetic flow meters for conductive liquids
- **OIML R49 / EN 14154** – Water meters for cold potable water
- **IEC/EN 61326** – EMC requirements for electrical equipment
- **NSF/ANSI 61** – Potable water system components – health effects

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- **WRAS / SABS Approved Materials**
- **IEC 60529** – Degrees of protection (IP ratings)

6.13. APPROVED MANUFACTURERS (TYPICAL EXAMPLES)

(Or equivalent subject to Engineer's approval)

- **KROHNE** – OPTIFLUX 2300 / WATERFLUX series
- **ABB** – WaterMaster or AquaMaster 4
- **SIEMENS** – MAG 5100W / MAG 6000
- **ENDRESS+HAUSER** – Promag W 300/400
- **BADGER METER, Yokogawa, or Sensus** potable models

6.14. QUALITY ASSURANCE

- Manufacturer must be ISO 9001 certified.
- Flow meters shall undergo functional testing prior to dispatch.
- Traceable serial numbers for full traceability.
- On-site commissioning to be performed by manufacturer's certified technician if required.

MER G: VALVE SPECIFICATION –PUMP STATION

This section covers the design, materials, manufacture, supply, testing, and installation of **Gate Valves, Non-Return (Check) Valves, and Pressure Relief Valves** for potable water service in a pump station. All valves shall be suitable for continuous operation with treated potable water, resistant to corrosion, and approved for potable water contact (WRAS, NSF/ANSI 61, or SABS potable-water compliance).

7.1. GENERAL REQUIREMENTS

- Valves shall be **flanged, full-bore type**, designed for potable-water duty, with **minimum pressure rating PN 16** (unless higher is required by design pressure).
- All wetted materials shall be **non-toxic** and **potable-water approved**.
- Valve construction shall prevent contamination and allow ease of maintenance.
- Valves shall be **bi-directional** where applicable and designed for a **minimum design life of 25 years**.
- Each valve shall be clearly marked with manufacturer's name, size, pressure rating, flow direction (where applicable), and certification marks.
- All fasteners in contact with water shall be **stainless steel A4-70 (316)** in accordance with ISO 3506.

7.2. GATE VALVES

7.2.1 Type

- **Resilient-Seated Gate Valves** with **non-rising or rising stem**, flanged ends, and **fully encapsulated ductile iron gate**.
- Operation: manually operated by **handwheel** or **gearbox with handwheel**, or **electric actuator** where specified.
- Valves to be **clockwise closing (CW to close)**.

7.2.2 Design & Manufacture Standards

- EN 1074-2 / ISO 7259 – Valves for water supply.
- AWWA C509 or C515 – Resilient-seated gate valves.

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- EN 558 – Face-to-face dimensions.
- EN 1092-2 / ISO 7005-2 – Flanges.

7.2.3 Pressure Rating

- Minimum **PN 16** (16 bar) unless otherwise specified.
- Seat tightness: 100 % tight sealing at full differential pressure.

7.2.4 Materials

Component	Material	Requirements
Body & Bonnet	Ductile Iron GGG-40/50 (EN-GJS-400-15)	Fusion-bonded epoxy internal & external coating $\geq 250 \mu\text{m}$, potable-approved
Gate / Wedge	Ductile Iron fully encapsulated with EPDM rubber	Drinking-water certified EPDM
Stem	Stainless Steel AISI 420 or 431	Rolled threads; non-corroding
Stem nut	Bronze or brass DZR	Non-dezincifying
Body bolts/nuts	Stainless Steel A4-70 (316)	Potable-approved anti-seize
O-rings & seals	EPDM or NBR potable-approved	Replaceable without removing valve from line
Coating	Fusion-bonded epoxy (FBE) min. $250 \mu\text{m}$, blue	WRAS/NSF certified

7.2.5 Features

- Full-bore design to minimize head loss.
- Low-torque operation with replaceable stem seals.
- Thrust collar with O-rings for stem sealing.
- Position indicator on rising-stem valves.
- Buried valves supplied with extension spindle and surface-mounted operating cap if required.

7.2.6 Testing

Each valve shall undergo:

- **Hydrostatic shell test:** $1.5 \times \text{PN rating}$.
- **Seat test:** $1.1 \times \text{PN rating}$, zero leakage both directions.
- Factory certificates to EN 12266-1.

7.3. NON-RETURN (CHECK) VALVES

7.3.1 Type

- **Swing-Type or Tilting-Disc Check Valves** for horizontal or vertical installation.
- Valves shall be **spring-assisted or lever-and-weight type** to prevent slamming and water hammer.
- Check valves shall be located immediately downstream of each pump discharge.

7.3.2 Design & Standards

- EN 1074-3 – Valves for water supply: Check valves.
- EN 558 – Face-to-face dimensions.
- EN 1092-2 – Flanges.
- AWWA C508 – Swing check valves.

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7.3.3 Pressure Rating

- Minimum **PN 16** (or to suit system).
- Tight sealing at $1.1 \times \text{PN}$, both directions.

7.3.4 Materials

Component	Material	Requirements
Body & Cover	Ductile Iron GGG-40/50	Fusion-bonded epoxy coated, blue
Disc	Ductile Iron or Stainless Steel, EPDM-faced	Potable-approved EPDM seat
Shaft / Hinge Pin	Stainless Steel 316	Corrosion resistant
Seat	EPDM bonded to body	Replaceable
Spring	Stainless Steel 316	For spring-assisted type
Bolts/Nuts	Stainless Steel A4-70	
Coating	Fusion-bonded epoxy $\geq 250 \mu\text{m}$	Potable-approved

7.3.5 Features

- Smooth, non-slamming closure to prevent surge.
- Accessible cover for inspection and maintenance.
- Disc to open fully at $\leq 0.3 \text{ m/s}$ flow velocity.
- Optional: **Hydraulic dampers** or **counterweights** for surge control.

7.3.6 Testing

- Shell pressure test: $1.5 \times \text{PN}$.
- Seat test: $1.1 \times \text{PN}$, zero visible leakage.
- Operational test: verify opening/closing performance under flow conditions.

7.4. PRESSURE RELIEF VALVES

7.4.1 Type

- **Pilot-operated spring-loaded diaphragm type**, designed for potable water systems to automatically relieve excess pressure and protect equipment and pipelines.
- Factory-set pressure per design drawings (typically 85–90 m head equivalent).
- Adjustable set point range: $\pm 10 \%$ of nominal.

7.4.2 Design & Standards

- EN 1074-5 – Valves for water supply: Control valves.
- AWWA C530 – Pressure-reducing and relief valves.
- ISO 5208 – Pressure testing.
- NSF/ANSI 61 – Potable-water compliance.

7.4.3 Pressure Rating

- Minimum PN 16; rated for full pump shut-off pressure + 10 %.
- Valve shall re-seat with no chatter and no leakage once normal pressure is restored.

7.4.4 Materials

Component	Material	Requirements
Body	Ductile Iron GGG-50 or Bronze	FBE coated internal/external
Trim (seat, stem, pilot internals)	Stainless Steel 316	Polished sealing surfaces
Diaphragm	EPDM, reinforced	Potable-approved
Pilot assembly	Bronze or Stainless Steel	Adjustable spring-loaded pilot
Fasteners	Stainless Steel A4-70	Potable-approved

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Component	Material	Requirements
Coating	Epoxy, blue, $\geq 250 \mu\text{m}$	WRAS/NSF certified

7.4.5 Features

- Pilot system includes:
 - Pressure-sensing line with isolation valve,
 - Adjustable pilot spring for pressure setting,
 - Strainer and orifice assembly,
 - Optional solenoid pilot for remote control.
- Valve shall relieve excess pressure rapidly and close drip-tight at normal system pressure.
- Provide isolating and by-pass valves for maintenance.

7.4.6 Testing

- Each valve pressure tested at $1.5 \times \text{PN}$.
- Functional bench test for relief opening and re-seating pressure.
- Factory calibration certificate to be supplied.

7.5. COATINGS AND CORROSION PROTECTION

- All cast iron and ductile iron components shall be internally and externally coated with **fusion-bonded epoxy (minimum $250 \mu\text{m}$)** in accordance with **AWWA C550 / EN 14901**.
- Coating shall be **potable-water certified** (WRAS / NSF / SABS).
- Surfaces shall be grit-blasted to SA 2.5 prior to coating.
- Coating colour: **Blue RAL 5015** (standard for potable water).

7.6 FASTENERS

- All bolts, nuts, and washers in contact with water shall be **Stainless Steel A4-70 (316)**.
- Threads lubricated with **potable-approved anti-seize compound** (PTFE-based).
- Torque tightened per manufacturer's recommendation.

7.7 TESTING AND INSPECTION

Each valve shall be factory tested in accordance with **EN 12266-1** and accompanied by test certificates confirming:

- Hydrostatic shell and seat test results,
- Visual and dimensional inspection,
- Coating thickness report,
- Potable-water certification (WRAS/NSF/ANSI/SABS).

7.8 INSTALLATION

- Valves shall be installed with correct orientation (flow direction arrow).
- Provide adequate space for operation and maintenance.
- Support heavy valves with pipe supports or pedestals to prevent pipe strain.

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- Isolating gate valves shall be installed upstream and downstream of each check valve and control valve to allow maintenance isolation.
- Pressure relief valve outlet to discharge to drain or return line as per design.

7.9 DOCUMENTATION AND DELIVERABLES

The Supplier shall provide the following for each valve type:

- Manufacturer's data sheets with dimensions, materials, and performance curves.
- Factory test and certification documents.
- Installation, Operation & Maintenance Manual (IOM).
- Spare parts list and recommended maintenance schedule.
- WRAS / NSF / SABS potable-water approval certificate.
- Coating and paint certification report.

7.10 APPROVED MANUFACTURERS (TYPICAL EXAMPLES)

(or Engineer-approved equivalents)

Valve Type	Typical Manufacturers / Models
Gate Valves	AVK Series 06, Glenfield, Erhard, Hawle, Premier Valves
Non-Return Valves	AVK Series 41, Cla-Val, Singer, Bermad, Erhard
Pressure Relief Valves	Cla-Val 50-series, Singer 106-PR/106-RPS, Bermad 700-series

7.11 STANDARDS REFERENCE SUMMARY

Component	Standard Reference
General water valves	EN 1074 series
Flanges	EN 1092 / ISO 7005
Testing	EN 12266-1 / ISO 5208
Coatings	AWWA C550 / EN 14901
Potable approval	NSF/ANSI 61 / WRAS / SABS
Check valves	AWWA C508
Gate valves	AWWA C509 / C515
Relief valves	AWWA C530

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MER H: ELECTRONIC PRESSURE GAUGE / PRESSURE TRANSDUCER SPECIFICATION

This specification covers the **design, materials, manufacture, calibration, supply, and installation** of **electronic pressure gauges and pressure transducers** used in potable water pump stations. The instruments shall measure **static and dynamic pressure** in suction, discharge, and header lines and transmit accurate signals to the **SCADA / PLC system** for monitoring, protection, and control.

8.1 SERVICE CONDITIONS

Parameter	Requirement
Medium	Treated Potable Water
Flow Rate (System)	Up to 90 L/s
Design Pressure (System)	2 500 kPa (250 m head)
Maximum Allowable Pressure	1.5 × system pressure
Temperature Range	0 °C to +60 °C
Location	Pump station (indoor/outdoor, humid conditions)
Mounting Orientation	Vertical, accessible for maintenance
Vibration Environment	High (pump discharge lines) – damping required

8.2. INSTRUMENT TYPE

- **Electronic Pressure Transmitter (Pressure Transducer)** with **local digital display** (optional, per application).
- **Output Signal:** 4–20 mA DC (2-wire loop-powered) or 0–10 V DC (if specified).
- **Power Supply:** 12–30 V DC.
- **Pressure Range:** As per location — typically:
 - **Pump suction:** 0 – (-100) kPa (vacuum to 0 bar)
 - **Pump discharge:** 0 – 2,000 kPa (0–20 bar)
 - **Header / manifold:** 0 – 2,000 kPa (0–20 bar)

8.3 DESIGN STANDARDS AND COMPLIANCE

Pressure transducers shall comply with the following standards:

Standard	Description
EN 61326	Electrical equipment for measurement, control, EMC requirements
EN 61010-1	Safety requirements for electrical equipment
EN 837-3	Pressure measurement – electronic transmitters
IEC 60529	Ingress Protection (IP) classification
ISO 17025	Calibration traceability
NSF/ANSI 61	Drinking water system components – health effects
SANS 1066	Pressure measurement devices
AWWA M33	Instrumentation and Control Equipment for Water Utilities

8.4 PERFORMANCE REQUIREMENTS

Parameter	Requirement
Measuring Range	0 – 20 Bar (typical, as per design)
Overpressure Capacity	1.5 × rated pressure without loss of accuracy
Burst Pressure	≥ 3 × rated pressure
Accuracy (Linearity + Hysteresis + Repeatability)	±0.25 % of full scale (FS) or better
Resolution	≤ 0.1 % FS
Response Time	≤ 10 ms

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Parameter	Requirement
Stability (1 year drift)	$\leq \pm 0.2$ % FS/year
Temperature Compensation	0 – 60 °C
Protection Class	IP67 (minimum); IP68 if submerged
Electrical Connection	M12 connector or cable gland with shielded cable
Process Connection	1/4" or 1/2" BSP male, Stainless Steel 316
Signal Output	4–20 mA, 2-wire (standard); optional HART protocol
Zero & Span Adjustment	Local digital or software calibration
Display (optional)	Backlit LCD, 4-digit, indicating pressure in kPa/bar

8.5 CONSTRUCTION AND MATERIALS

Component	Material / Requirement
Sensor Type	Piezoresistive or Thin-film strain gauge, stainless steel diaphragm
Pressure Connection	Stainless Steel 316, 1/2" BSP male
Wetted Parts	Stainless Steel 316L or Hastelloy C276
Sensor Seal	EPDM or FKM (WRAS / NSF approved)
Housing / Enclosure	Stainless Steel 316 or Polyamide with IP67 rating
Electrical Connector	M12 × 1 plug or sealed cable entry (IP67/IP68)
Cable	Shielded polyurethane or PVC, 3 m minimum length
Filling Medium	Food-grade silicone oil or dry cell (no contamination risk)
Mounting Fittings	Stainless Steel 316 tee and isolation valve with snubber
Label	Engraved stainless-steel tag with gauge ID and range

8.6 ACCESSORIES

Each pressure transducer shall be supplied complete with:

Item	Description
Isolation Valve (Gauge Cock)	1/2" SS316 ball valve with lever handle
Pressure Snubber / Pulsation Damper	Adjustable, SS316, for surge protection
Mounting Tee / Nipple	SS316, threaded BSP
Flexible Hose (if remote mount)	SS braided PTFE hose, min 1 m
Electrical Connector Kit	Shielded cable with strain relief gland
Calibration Certificate	Traceable to ISO 17025 standards

8.7 ELECTRICAL AND CONTROL INTEGRATION

- Each transducer shall provide a **linear 4–20 mA signal** proportional to measured pressure.
- The **zero (4 mA)** shall correspond to 0 kPa (or vacuum for suction applications).
- **Span (20 mA)** shall correspond to full-scale rated pressure.
- Signal cables shall be **shielded twisted pair** and routed separately from power cables to prevent EMI interference.
- Each transducer shall include **reverse polarity and surge protection**.
- **Grounding** of shield at control panel only.
- Output wiring shall be compatible with **PLC / SCADA Analog input modules**.
- Transducers shall support **HART communication** for configuration (optional).

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8.8 INSTALLATION REQUIREMENTS

- Install pressure transducers in **accessible, vibration-free locations**.
- Mount via isolation valve and snubber on discharge or suction manifold.
- Ensure pressure ports are oriented **vertically upward** to avoid air pockets.
- Do not install transducers directly on pump casings.
- Electrical cable entries shall be sealed against water ingress (IP67).
- All wiring terminations to be labelled and documented.
- Provide **SS316 mounting brackets** for panel or wall mounting if remote.

8.9 TESTING, CALIBRATION, AND DOCUMENTATION

8.9.1 Factory Testing

Each pressure transducer shall undergo:

- **Hydrostatic pressure test** at $1.5 \times$ rated pressure (no leakage or drift).
- **Electrical signal calibration** across full range (0–100 % FS).
- **Temperature compensation** verification (0–60 °C).

8.9.2 Factory Documentation

The supplier shall provide:

1. Factory calibration certificate (ISO 17025 traceable).
2. Material certificates to EN 10204 Type 3.1.
3. Performance test report (linearity, hysteresis, repeatability).
4. Potable water compliance certificate (WRAS / NSF / SABS).
5. Installation, Operation & Maintenance (IOM) manual.
6. Recommended spares list.

8.9.3 Site Calibration

- Verify field calibration before commissioning using a **digital reference manometer**.
- Re-calibration interval: 12 months minimum.

8.10 IDENTIFICATION AND TAGGING

Each electronic pressure gauge/transducer shall be permanently marked or tagged with:

- Equipment tag number (e.g., **PT-201**),
- Manufacturer name and model,
- Range and accuracy,
- Output signal type (e.g., 4–20 mA),
- Serial number,
- Date of calibration,
- Potable water approval logo (WRAS / NSF / SABS).

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8.11 TYPICAL APPROVED MANUFACTURERS

Manufacturer	Typical Models
WIKA	S-10, A-10, or O-10 Series
Endress+Hauser	Cerabar PMC11 / PMP11 / PMP51
KOBOLD	SEN-96 / PDM Series
VEGA	VEGABAR 38 / 83 Series
ABB	2600T Series
Yokogawa	EJA438E Pressure Transmitter
Siemens	SITRANS P200 / P300

Equivalent products from other manufacturers may be submitted for approval, subject to compliance with all requirements in this specification.

8.12 SUMMARY OF REQUIREMENTS

Parameter	Specification
Type	Electronic pressure transducer / transmitter
Output	4–20 mA DC (2-wire)
Range	0–20 bar (discharge) / 0–(-1) bar (suction)
Accuracy	±0.25 % of FS
Material (wetted)	SS316L / Hastelloy
Seal	EPDM potable-water approved
Housing	SS316, IP67 minimum
Power Supply	12–30 V DC
Calibration	ISO 17025 certified
Approval	WRAS / NSF / SABS potable-water compliant
Accessories	Isolation valve, snubber, mounting fittings
Communication (optional)	HART protocol
Installation	With isolation and damping protection

8.13 COMPLIANCE AND QUALITY ASSURANCE

All electronic pressure gauges/transducers supplied shall:

- Be **new, of proven field performance**, and **free from toxic materials**.
- Carry valid **potable-water safety certification** (WRAS, NSF/ANSI 61, or SABS).
- Be **factory-calibrated**, traceable to recognized standards.
- Include **IP67/IP68 rating** suitable for the humid pump station environment.
- Be **tested, inspected, and approved** by the Engineer before shipment.

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PSEL: ELECTRICAL SPECIFICATION

PSEL1 ELECTRICAL SCOPE

1.1 GENERAL

1.1.1 Scope

The contract covers the supply, delivery, installation, operation, testing and maintenance during the defects liability period of the electrical installation for the High Lift Pump Station, Intake Tower and Street Lighting covered by this Contract, comprising the LV infrastructure, MCCs, free standing VSDs, street lighting, instrumentation, communication network, telemetry system and general electrical installation in complete working order. The Electrical and Instrumentation scope covers the following processes:

- Installation of 1000kVA standby generator
- Installation of 2x240mm² PP EMC supply cable to the pump station MCC.
- 50m cable trench excavation and backfilling for the supply cable.
- Installation of the MCC as illustrated in the pump station electrical layout and intake tower electrical layout drawings drawing.
- Installation of 3x110kW and 3x160kW free standing VSDs
- Installation of a PLC and RTU.
- Installation of a telemetry system.
- Installation of sensors and actuators
- Installation of streetlights along a 5km long access road including accessories.
- General building installation as illustrated in electrical layouts drawings

Unless stated otherwise in this project specification, all equipment and work carried out must be in accordance with SANS 10142-1. References given in any section are for the Contractor's convenience, and it remains the Contractor's responsibility to consult all standards and specifications to ensure compliance.

Compliance With Act

The complete installation shall be in accordance with the Occupational Health and Safety Act (Act 85, 1993). The Contractor's attention is drawn to the requirements of SANS 10142.

1.2 LOW VOLTAGE INFRASTRUCTURE

1.2.1 Scope

The LV infrastructure scope covers the following:

- Supply and installation of supply/incomer cables (2x 240mm² 4C+E PP EMC double screening) from the generator changeover panel to the HLPS MCC.
- Supply and installation of a 1000kVA standby diesel generator equipped with sound attenuation and ATS.
- Supply and installation of all cables from the MCC to the loads, including control and instrumentation cables.
- Supply and installation of MCC and the complete electrical and instrumentation installation.
- Installation of a new Programmable Logic Controller (PLC) and HMI.
- Supply and installation of a telemetry system to synchronise the operation of the Intake Tower, HLPS and Mayflower WTW & Methula WTW.
- Supply and install small power and lighting for the Generator Room, HLPS MCC and Intake Tower, as indicated in electrical layout drawings.
- Supply and installation of street lighting along a 5km long street.
- Supply and installation of electrical earthing and lightning protection for all new installations and the building and structures.

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1.2.2 MCC LV Feeder Cables

1.2.2.1 LV Cable Work

Supply and install 100 meters of 240mm² 4 core PP EMC double screening, + 120mm² ECC PVC bedded SWA PVC sheathed 600/1000V cable manufactured as per SANS 1507-4.

The cables shall be ran from the miniature substation to the generator changeover panel to the HLPS MCC.

The cables shall be ran through cable trenches and through cable sleeves (under the roadway and under buildings). Where the cable needs to be run on the surface, it shall only be run through hot-dipped galvanised cable ladders.

1.2.2.2 Cable Trench

The Contractor shall prepare a 550mm deep and ± 900mm wide trench. The cable trench shall be prepared from the mini-sub to the generator room, from the generator room to the HLPS MCC. Upon backfilling, the Contractor shall rehabilitate the ground and make good, including tarring, concrete and paving, where applicable. The Contractor shall also install concrete cable markers with an arrow showing the direction of the cable and on every point where the cable changes direction, a cable direction clearly marked on the cable marker.

Before the cables are laid, the bottom of the trench shall be covered with a 75 mm layer of earth which shall have been passed through a sieve with a maximum mesh of 12 mm. The Electrical Contractor shall lay the cables on the prepared bed carefully to avoid cuts and damage. Cable rollers shall be used.

The trench shall be back-filled with clean builder's sand to provide 150 mm of cover as soon as possible after the cable has been laid. To prevent theft and possible damage, long lengths of cable shall not be left exposed in an open trench overnight. The trench shall be back-filled and compacted in layers to achieve 100% compaction.

Water shall not be allowed to accumulate at any part of the works. The Electrical Contractor will therefore ensure that no cable laying is carried out until the trenches are free from water.

All cables shall be covered with a light yellow plastic warning sheet 450 mm in width of approved design with the skull and cross bones insignia together with the words "DANGER, GEVAAR, INGOZI" printed in black at regular intervals. The warning shall be placed 300 mm above the top of the cables.

Note: where it is not practical to comply the abovementioned installations, the Contractor shall propose alternative options to the Electrical Engineer and only execute them upon approval.

1.2.2.3 Cable Ladders

Supply and install cable ladders to be run on the pump station building walls, and trenches, from the bottom of the MCC panel. The cable ladder shall be 500mm wide and 75mm high with 11x 28mm cross rung slots and shall be of hot-dip galvanized standard finish. Cable ladders shall be fitted with a cable ladder cover.

Cable ladders shall be supplied with all accessories i.e. Horizontal bends, plices set and all joints or plices shall be bonded using a 6mm² earth wire. In addition, cable ladders shall be bonded to the massive earth in the substation/LV switchboard.

Cables shall be clamped on the cable ladder using Q clamps on every rung. Where the cable ladder enters through a building, a sealing foam shall be filled to close up the openings.

1.2.2.4 Cable Sleeves

Where cables runs under or through concrete, the Contractor shall supply and install 110 mm diameter flexible convoluted tubing with impact resistance and UV stability and also meet the construction industry requirements for conduits in concrete slabs, columns, beams and decks.

Cable Sleeves shall be supplied and installed with a proper sleeve joint kit and sleeve caps. At no stage shall cable sleeves be left without caps laying in trenches.

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1.2.2.5 Testing of Cables

Cables shall be inspected and quality tested at the factory prior to dispatch. After delivery on-site and prior to installation, the drum(s) must be visually inspected for damage and Optical Time Delay Reflectometry (OTDR) drum tests must be done on all cores. The factory must provide the necessary quality and test certification, and the Contractor must provide the on-site drum test certification. All certificates must form part of the formally submitted documentation.

Should any damage be detected, the whole drum must be replaced. Protective caps should be fitted to protect exposed fibres at all times.

The Contractor shall have a work schedule indicating all the stages involved in the cable installation.

The Contractor shall conduct the following minimum test;

- A. Visual and mechanical inspection:
 - Inspect exposed section of the cable for physical damaged
 - Verify tightness of accessible bolted electrical connections with a calibrated torque-wrench method in accordance with manufacturer's recommendations. All torqued bolts shall be recorded on a test sheet for records.
 - Inspect compression-applied connectors for correct cable match and indentation.
 - Inspect shield grounding, cable supports and termination.
 - Verify that visible cable bends meet or exceed the manufacturer's minimum published bending radius.
 - Inspect fireproofing in common cable areas.
 - Inspect if the current transformer or any protective device is correctly placed and positioned.
 - Inspect for correct identification and arrangements.
 - Inspect for cable jacket and insulation condition.
- B. Electrical Tests
 - Insulation Resistance:
 - Cables shall be tested for insulation resistance with an insulation tester (i.e. Megger) at 1000 Volts for 1 minute.
 - The minimum insulation resistance to earth or between phases shall be 100 mega-ohms.
 - The instrument used for this measurement shall have a minimum resolution of 10 mega-ohms on the 0 to 500 mega-ohm range.
 - Phasing Test:
 - The correct phasing of all LV circuits shall be checked at all positions where the LV cables are terminated into fuse bases and where any LV cable is run from point to point.
 - This test shall be performed with an instrument designed for the purpose. The mains frequency voltage of 240 Volts is not acceptable for this test.
 - The neutral conductor shall be connected to the earth stake for this test.
 - Continuity Test (resistance of bolted connections):
 - For loop LV systems, a continuity test shall be carried out on each LV circuit to ensure that all bolted connections are complete and adequate. The test shall be carried out as follows:
 - (1) At the transformer, firmly bond all 4 conductors together
 - (2) Undertake a continuity test at every point where there is a service provision or open point. In a fused service pillar, the bottom row of fuses bases must be the point at which the test is undertaken, as that is the furthest extent of the network.
 - The difference between the readings of each phase conductor and the neutral for each test shall not be greater than 10% of each other. Any difference greater than this may indicate a loose or dirty connection and will require further investigation.
 - The instrument used for this measurement should have a resolution to the second decimal point in the 0 to 5-ohm range.
 - A typical instrument would be the earth "Megger" type and taking into account the resistance values of the test leads.
 - Earth Resistance Test:
 - In any overhead or underground network the earth resistance at any point along the length of a LV feeder is to have a maximum resistance of 10 ohms prior to connection to the existing network.

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- In any overhead or underground network, the overall resistance to earth Shall be less than 1 ohm prior to connection to the existing network.

After the LV insulation resistance testing, the neutrals must be connected to the earth stakes.

For the installation to be accepted the cables shall have passed all tests listed above and all tests shall form part of the OEM Manual for the project.

Note that all testing equipment shall be calibrated and have a valid calibration certificate.

1.2.3 MCC Construction

1.2.3.1 General

The MCC GA and single line drawings are typical only. The Electrical Contractor is responsible for detailing the MCC panel. The Contractor must submit each design drawing for approval, and no material or fabrication of the panels shall commence without the approval of the Electrical Engineer.

The MCC and related equipment must conform to the following general requirements:

1.2.3.1.1 Environmental Conditions

The MCC and equipment shall be able to function under the following environmental conditions:

Indoor: The design temperature for indoor MCC and equipment must be 50°C for ventilation without an air conditioning unit (AC). The environment is also highly corrosive and that must be considered when selecting the equipment and materials to be used in building the MCC.

1.2.3.1.2 General Construction

The following diverse specification items must be noted (but is not limited to):

- Floor standing MCC must be provided with a 50mm x 100mm hot-dipped galvanised U-channel base.
- Fixed cubicle construction must be used.
- Protection degree: IP 42, minimum.

1.2.3.1.3 Control Voltage

Panel internal: 230 V AC +/-15 %

Instrumentation, and external (to MCC) devices: 24V DC +/-15 %

1.2.3.1.4 Surge Protection

The incoming section must be provided with surge protection in accordance with SANS 10142-1. Both Class 1 and Class 2 coordinated protection must be provided, directly adjacent to each other, with curve C backup protection circuit breakers, rated in accordance with the manufacturer's recommendation.

The surge arrestors must be of the clip-in type, having both-end-of life and safety reserve visual indication, as well as provision for operational status remote monitoring. Electronic equipment must, in addition be provided with suitable equipment-specific coordinated surge protection.

1.2.3.1.5 Cable Entry Bucket

The cable entry bucket shall have a bottom/ side cable entry and must be designed and constructed to enable 2x240mm² 4 core PP EMC + earth Copper bedded SWA PVC sheathed cables to be glanded with ease and without deforming the panel. The panel shall be adequate in depth and enable the right bending radius of each core as it enters the incomer cubicle of the MCC.

A clean cut with no sharp edges shall be prepared during panel fabrication to enable cables to enter the main incomer bucket A1.

1.2.3.1.6 Main Incomer Bucket A1

Note: since the door for the Main CB will not have any mechanical interlocking mechanism, all live parts shall be covered by Perspex or an approved insulation sheet and shall not be accessible without the use of tools. The main incomer bucket shall be fitted with an 1600A, 4-pole, 415V, fixed circuit breaker with the following features:

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- **High Ampere Interrupting Rating (AIR):** ANSI Certified circuit breakers have an interrupting rating of 200,000A at 508 VAC without fuses.
- **High Short-Time Current Rating:** The circuit breaker shall have exceptional short-time ratings—up to 100,000A.
- **100% Rated Circuit Breaker:** Circuit breakers shall be designed for continuous operation at 100% of their current rating.
- **Reverse Fed Circuit Breaker:** Circuit breakers shall be fed either from the top of the circuit breaker or from the bottom.
- **Two-Step Stored Energy Mechanism:** Circuit breakers shall be operated via a stored-energy mechanism, which can be charged manually or by a motor. The closing time shall be less than five cycles. Closing and opening operations can be initiated by remote control or by push buttons on the circuit breaker front cover. An O–C–O cycle shall be possible without recharging.
- **Field-Installable Trip Units, Sensor Plugs and Accessories:** Trip units, sensor plugs and most accessories shall be field-installable with only the aid of a screwdriver and without adjusting the circuit breaker. The uniform design of the circuit breaker line shall allow most accessories to be common for the whole line.
- **Reinforced Insulation:** Two insulation barriers separate the circuit breaker front from the current path.
- **Isolation Function by Positive Indication of Contact Status:** The mechanical indicator that is truly representative of the status of all the main contacts.
- **Segregated Compartment:** Once the accessory cover has been removed to provide access to the accessory compartment, the main contacts remain fully isolated. Furthermore, interphase partitioning allows full insulation between each pole even if the accessory cover has been removed.
- **Front Connection of Secondary Circuits:** All accessory terminals (ring terminals shall be available as an option) shall be located on a connecting block accessible from the front in the connected, test, and disconnected positions, which shall be useful for field inspection and modification.
- **Anti-Pumping Feature:** Circuit breakers shall be designed with an anti-pumping feature that causes an opening order to always take priority over a closing order. Specifically, if opening and closing orders occur simultaneously, the charged mechanism discharges without any movement of the main contacts, keeping the circuit breaker in the open (OFF) position.

In the event that opening and closing orders are simultaneously maintained, the standard mechanism provides an anti-pumping function which continues to keep the main contacts in the open position. In addition, after fault tripping or opening the circuit breaker intentionally (using the manual or electrical controls and with the closing coil continuously energized) the circuit breaker cannot be closed until the power supply to the closing coil is discontinued and then reactivated.

NOTE: When the automatic reset after fault trip (RAR) option is installed, the automatic control system must take into account the information supplied by the circuit breaker before issuing a new closing order or before blocking the circuit breaker in the open position. The information is on the type of fault, e.g. overload, short-circuit or ground fault.

- **Disconnection Through the Front Door:** The racking handle and racking mechanism shall be accessible through the front door cutout. Disconnecting the circuit breaker is possible without opening the door and exposing live parts.

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- The incoming section must be provided with surge protection in accordance with SANS 10142-1. Both Class 1 and Class 2 coordinated protection must be provided, directly adjacent to each other, with curve C backup protection circuit breakers/ fuses in a fuse holder, rated in accordance with the manufacturer's recommendation.
- The surge arrestors must be of the clip-in type, having both end-of-life and safety reserve visual indications, as well as provision for operational status remote monitoring. Electronic equipment must in addition be provided with suitable equipment-specific coordinated surge protection.
- The pane shall have an ember LED labelled surge arrester blown, it shall light up when the surge arrester has blown.
- Surge arrestors shall be rated for 50kA per phase, and a total of 100kA for 4 poles.

1.2.3.1.7 Metering Bucket A2

The metering cubicle shall be fitted with a power quality meter completed with its accessories and protection components, to perform the following minimum functions;

The meter shall be used to monitor electric distribution to the LV network. It shall be ideal for independent power producers and cogeneration applications that require the accurate bi-directional measurement of energy. It is well suited to load curtailment, equipment monitoring and control and energy pulsing and totalisation, applications. Integrate it with Power Management Software applications to get the most out of the meter's capabilities and data produced.

The supplied meter shall be capable of performing the following applications;

- Revenue metering
- Cogeneration and IPP monitoring
- Power Quality Compliance monitoring
- Power quality analysis
- Demand and power factor control
- Load curtailment
- Equipment monitoring and control
- Energy pulsing and totalisation
- Instrument transformer correction
- Outage Notification

The power energy meter feature shall include:

- 9S, 35S, 36S socket and switchboard cases
- True RMS 3-phase voltage, current, power and meets stringent ANSI revenue metering standards including ANSI C12.20 0.2 and Class 2, 10, & 20
- Power quality: sag/swell, individual, even, odd, total harmonics to the 31st and symmetrical components
- 32 Mb log/event memory, min/max for any parameter, historical logs up to 80 channels, timestamp resolution to 0.001 seconds and GPS time synchronisation
- Transformer/line loss compensation and Instrument transformer correction
- Communications: Ethernet, Serial, Modem, Internet and Ethernet to the serial gateway and ION, DNP 3.0, Modbus RTU, Modbus TCP, MV-90 protocols, IEC 61850
- C model limited to IR + 2 other ports at one time. Ports can be enabled/disabled by the user
- Dial-out capability when memory is near full
- Multi-user, multi-level security with control and customized access to sensitive data for up to 50 users
- Data push capability through SMTP (email)
- 65 set points — math, logic, trig, log, linearisation formulas
- Password protection and anti-tamper seal protection
- Built-in I/O: 4 KYZ digital outs and 3 form A digital ins, 4 KYZ digital outs and 1 form A digital out and 1 form A digital in, an optional external I/O expander provides additional I/O
- Optional Outage Notification Card for JSON outage notification message over Ethernet

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- Waveform capture up to 1024 samples/cycle, PQ compliance monitoring, flicker to EN50160 Ed2, IEC 61000-4-7/4-15 (also configurable to IEEE519 2014, IEEE159, SEMI) CBEMA/ITIC
- Transient detection to 17µs at 60 Hz
- Harmonics: magnitude, phase and inter-harmonics to the 50th
- 128 Mb standard memory
- Max 96 cycles of waveform logs and 800 channels of historical logs

Busbars Buckets

Only rectangular copper busbars shall be used throughout the MCC. The busbars shall be accessible from the top of the panel. The busbars shall be designed and made as per SANS 1195 and SANS 10142.

The busbars shall be fitted with temperature and humidity sensors (wireless smart sensors for continuous environmental condition monitoring). They should be placed on both the supply and load side for all three phases and neutral terminals of the main circuit breaker, as well as on every meter interval on all three phases and neutral throughout the busbar buckets. These smart sensors should be connected to a newly supplied controller in the metering bucket.

Drive Cubicles

Each drive cubicle shall be equipped with the following equipment:

- Isolation circuit breaker, fitted with auxiliary contact to cut out the control power supply to the VSD/motor control and to indicate on the PLC the status of the isolation circuit breaker.
- Door mount operating panel for VSD
- Function selector switch.
- Control pushbuttons start, stop and reset as specified in the FDS.
- Status indication lights as specified in the FDS.
- VSD to drive dedicated motors.
- Motor control with smart relays for DOL starters.
- Control voltage:

Panel internal: 230 V AC +/-15 %

Instrumentation and external (to MCC) devices: 24V DC +/-15 %

- Complete control circuit with associated components to enable full functionality and protection of the driven motor and system

Note that the live part of the MCCB shall be covered with a minimum of 4mm thick polycarbonate, or any form of approved insulation.

Potable Pumps Feeders

There shall be 6 cubicles with 2 sets of 3 pumps. The first set consists of 200A MCCB 3 pole protecting 70mm² 4 core PP ECC cable supplying free standing VSDs. The second set consists of 300A MCCB 3 pole protecting 95mm² 4 core PP ECC cable supplying free standing VSDs. Each cubicle shall be fitted with a rotary door handle with an overridable mechanical interlocking mechanism to prevent the door from opening while the cubicle is live.

Note that the live part of the MCCB shall be covered in polycarbonate or any form of approved insulation

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Control transformer

The transformer shall be designed or selected to have an adequate space for installation, maintenance and to allow efficient natural air cooling 16A 2 pole CB, with a rotary door handle fitted with a mechanically interlocking mechanism.

A 10kVA 400/230V transformer shall be mounted inside the cubicle, there shall be adequate clearance between the transformer, CB's and enclosure to allow for air circulation.

The transformer shall comply with the following specifications

Basic	Phase	3 phase in 1 phase-out
	Capacity	10 kVA
	Weight of Aluminium Wire Transformer	Open type: 75kg Protected type: 96kg
	Weight of Copper Wire Transformer	Open type: 78kg Protected type: 98kg
Technical Parameters	Primary Voltage	400V (Optional: 120V/ 190V/ 208V/ 220V/ 230V/ 240V/ 380V/ 400V/ 415V/ 480V)
	Secondary Voltage	240V (Optional: 120V/ 190V/ 208V/ 220V/ 230V/ 240V/ 380V/ 400V/ 415V/ 480V)
	Frequency	50Hz
	Winding Material	Copper wire
	Work Efficiency	≥95%
	Insulation Resistance	≥50 MΩ
	Electrical Strength	3000V AC/1 min
	Noise	<35-65dB (1 meter)
	Insulation Grade	H level
	Wiring Mode	Dyn11
	Cooling Mode	Dry type natural air cooling
	Overload Capacity	Allow more than 1.2 times the rated load to work for up to 4 hours And 3-5 times the capacity for 10 seconds

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Working Environment	Certificate	CE, ISO
	Warranty	12 months
	Temperature	-15°C~+40°C
	Humidity	≤90%RH,

Local DB

Local DB feeder shall be fitted with 63A 3 pole CB fitted with a rotary handle with inter lockable mechanism

1.2.3.2 PLC Cabinet

The PLC Cabinet shall be powered from the PLC power supply unit. The Power supply shall be supplied and installed with a 24V 100Ah lithium battery.

The MCC GA, PLC cabinet shall be used as a guideline, the Contractor shall be responsible for detailing, fabricating and installing the PLC cabinet with adequate space to house all required components. The PLC cabinet shall be designed, constructed and installed as per MCC GA. The panel shall be fitted with an HMI on the outer door.

All components shall be mounted on the base plate inside the panel, and all live terminals shall be covered by a clear polycarbonate sheet that can be easily removed during maintenance.

All circuit breakers, PLC and other components shall be clearly and permanently labelled

Cables shall be run through slotted trunking, and there should be a 30% spare capacity for further additional work.

Surge arrestors shall be installed on the supply power to the PLC cabinet and on the terminals for all field equipment.

1.2.3.3 MCC Testing

Before purchasing any items (CBs, VSD isolators, PLCs, inverters, batteries, and all electrical items required to build the MCC), the contractor must submit the equipment list to the Electrical Engineer for approval. Once approved, the Contractor shall submit shop drawings for the MCC enclosure and ensure that all the equipment fits according to the MCC panels and the MCC fittings in the MCC room. The Client Quality Control representative shall provide a list of their requirements and the number of factory inspections and tests that need to be witnessed by Client representatives.

The Contractor shall prepare a method statement for all inspections and tests to be conducted and submit it to the Electrical Engineer for approval.

1.2.3.3.1 Testing during manufacturing

The Contractor shall invite the Electrical Engineer to witness tests during manufacturing within 14 days. The Employee's agent will then submit a list of representatives to attend the witnessing of tests to the Contractor, and the Contractor shall cover all travelling costs.

These tests include:

- The inspection of material used in fabricating the MCC enclosure.
- The paint thickness test after the metalwork has been completed

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1.2.3.3.2 Factory Acceptance Test (FAT)

Upon completion of wiring the MCC, the Contractor shall invite the Client representatives to witness all practical tests.

The Contractor shall prepare a method statement with a list of all tests to be witnessed by the Client representatives during the FAT. The Electrical Engineer has the right to request that more tests be conducted if necessary.

Note that all testing instruments shall have a valid calibration certificate during the FAT and project execution. i.e., the operation of the MCC at full capacity, the request for performance of VSDs, and witnessing the simulation of all controls and interlocks.

1.2.3.4 Commissioning

The Contractor shall prepare and submit a Site Acceptance Test (SAT) file to be followed during the commissioning.

The system acceptance test file shall include the minimum;

The system acceptance test shall cover each and every item installed, including each mechanical test as per the OEM manual,

Level 2: Initial and construction testing, including visual inspection of the installation checklist before the system goes live. testing (I/O testing and verification of all cabling, Electrical current/resistance/insulation testing, primary and secondary injection testing, verification of discrimination settings and megger testing (dead) of cables. – Pre-start (supplier) checklist is delivered complete with the documentation to document control).

Level 3: Start-up testing, including energising, checking all settings and documentation, conducting performance testing, etc.

Level 4: site acceptance testing, testing the performance of the system with predefined conditions and in relation to other systems in order to assess the quality and detect possible errors, including system acceptance tests, complete functional testing of all subsystems, complete performance testing of all subsystems, verification of consistency between systems, testing interfaces of steering system, including all remote controls, testing all safety and emergency scenarios and full load testing of the system.

Level 5: Integrated site acceptance testing, testing for redundancy on the system, integrated performance testing, and backup system tests, including total power outage tests.

Level 6: training and instruction before and after handover, training programs established and monitored by original equipment manufacturers, including training programs for maintenance personnel and operators.

1.2.3.5 Training

Two types of training shall be conducted on the MCC: one for operators and one for the maintenance team.

Training for operators shall cover the entire operation of the MCC, driven equipment and MCC, including the operation of field instruments. This can be on-site training and shall be a 5-day training with 5 attendances

Training maintenance team, this training shall cover the maintenance of the entire MCC, including all instruments, circuit breaker, VSD's Invoices and field instruments, the training shall be conducted for 5 days with 5 attendance

The Contractor shall allow for refreshments during each training, including lunch for all attendants

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1.3 STANDBY GENERATOR

1.3.1 General Specification

The contract includes the manufacture, testing, delivery, rigging, commissioning and hand-over of the generating set (diesel engine coupled to an alternator mounted on a base mounted fuel tank), this shall include for the FAT prior to delivery for the client and engineers.

The pump station shall have a standby power generator set; this will be adequately sized to support the pumping system in the event of loss of Eskom supply. The generator shall be housed in a newly constructed bund base within the generator room and shall supply the new motor control panel via an ATS switch built into the generator room.

The generator shall meet the following specifications outlined as follows;

Engine

- a) Heavy-duty diesel engine Six cylinder equipped with piston cooling
- b) Electronic governor control system
- c) Replaceable wet type cylinder liners
- d) 24V DC starter and charge alternator
- e) Replaceable fuel filter, oil filter and dry element air filter
- f) Cooling radiator and fan fuel connection hoses and manual sump oil drain valve
- g) Exhaust silencer
- h) Maintenance free battery including racks and cables
- i) Jacket water heater

Alternator

- a) Brushless, single bearing system, four poles
- b) Insulation class H with circuit breaker protection
- c) Standard degree of protection IP21
- d) Self-exciting and self-regulating
- e) Half-wave phase-controlled thyristor type Automatic Voltage Regulator (AVR)
- f) Screen protected and drip proof
- g) Stator winding with 2/3 pitch for improved harmonics
- h) Close voltage regulation

Chassis

- a) Steel chassis and anti-vibration pads
- b) Base frame design incorporates an integral fuel tank of 360 litres
- c) The generator can be lifted or carefully pushed/pulled by the base frame
- d) Includes diesel level sensor information to the controller

Canopy

- a) Ventilation parts are designed with modular principles
- b) Weather resistant and lined with sound reducing foam
- c) All metal canopy parts are painted by powder paint
- d) Panel window Lockable doors on each side
- e) Easy maintenance and operation
- f) Easy lifting and moving
- g) Insulated engine exhaust system
- h) Exterior emergency stop push button

Auto Mains Failure Control Panel

- a) Intelligent European specification automatic transfer switch module
- b) Electronic controller unit with mains quality sensing, event logging and alarms
- c) Emergency stop push button with remote signalling
- d) Static battery charger
- e) Four-pole electrically and mechanically interlocked automatic transfer switch

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Metering Via LCD Display

- a) Generator volts (L-L/L-N); mains volts (L-L/L-N)
- b) Generator amps (L1, L2, L3); generator (kVA and kW)
- c) Generator frequency; generator (cos)
- d) Engine hours run; plant battery (volts)
- e) Engine oil pressure (psi and bar)
- f) Engine speed (rpm)
- g) GSM SMS signal
- h) Engine temperature (°C)

Automatic Shutdown and Fault Condition

- a) Under/over speed; fail to start
- b) High engine temperature; fail to stop
- c) Low oil pressure; charge fail
- d) Under/over generator volts; over current
- e) Under/over generator frequency; emergency stop
- f) Under/over mains frequency
- g) Under/over mains voltage
- h) Low/high battery volts

Dimension

- a) Length x Width x Height 6100mm x 2440mm x 2700mm
- b) Dry weight 12000kg
- c) Generator bund is required.

1.4 STREET LIGHTING

1.4.1 General Requirements

The Contractor shall supply, install, test and commission a complete access road lighting system for a 5 km section of the access road.

All materials and workmanship shall comply with the latest editions of SANS 10142, SANS 10098, SANS 60598, NRS 048 and applicable road authority specifications.

All equipment shall be new, unused and suitable for outdoor installation in harsh environmental conditions.

1.4.2 Design Criteria

The installation of streetlights shall conform, but not limited to, to the following criteria;

- Road classification: Single carriageway access road.
- Design speed: 80–100 km/h.
- Lighting classification: ME3.
- Spacing: 30 m single-sided arrangement.
- Mounting height: 10 m.
- Total number of poles: Approximately 168.

1.4.3 Power Supply

The Contractor shall supply power to the street lights, tapping from the 11kV overhead lines supplying power to the high lift pump station. The power supply shall be via pole fused links and located at the centre of the access road (approximately 2.5km). A plinth mounted 100kVA miniature substation shall be used to step down 11kV to 420V, where an integrated LV distribution panel will be connected. This miniature substation shall be equipped with dry type transformer compliant with SANS 780. The plinth shall have a boundary fencing made of clear-vu and the gate with an alarm system to protect the equipment against theft and vandalism.

1.4.4 Feeder Pillar and Control

The feeder pillar shall be IP55 minimum outdoor-rated enclosure. This shall be fed from the miniature substation LV compartment and shall conform to the following specifications;

- 100 A 3-phase main breaker.
- Class I and II surge protection.
- Astronomical timer for automatic switching.

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Contact control system.
Minimum six outgoing protected circuits.

1.4.5 Underground Reticulation

The Contractor shall supply and install 4-core 25 mm² Aluminium XLPE/SWA/PVC rated 600/1000 V underground cables to cover a 5km long access road. The cable trench depth shall be 550mm minimum, 900mm wide. The warning tape shall be installed 300mm above buried cable. 110mm diameter HDPE sleeves shall be installed to run cables at road crossings. The contractor shall ensure that voltage drop does not exceed 5%.

1.4.6 Street Lighting Poles

The Contractor shall supply and install 10m tapered octagonal steel poles. The poles shall conform to the following specifications;

- Hot-dip galvanised finish.
- Flange-mounted with 4 x M24 anchor bolts.
- 1.2 m outreach arm.
- Designed for 40 m/s wind loading.

Foundations shall be 800 x 800 x 1500 mm mass concrete (30 MPa).

1.4.7 LED Luminaires

The access road LED luminaires shall comply with SANS 60598 and the following specifications;

- Power rating: 120–150 W.
- Minimum efficacy: 140 lm/W.
- IP66 minimum protection.
- IK08 impact rating.
- Colour temperature: 4000K.
- Internal surge protection minimum 10 kA.

The Contractor shall perform photometric tests and submit to the Electrical Engineer for approval, before ordering of lights. The photometric performance shall comply with ME3 lighting class requirements and SANS 10098, EN 13201 standards.

1.4.8 Earthing and Bonding

The Contractor shall make sure that each pole is be bonded to earth using 16 mm² copper conductor. Earth electrodes shall be installed at mini-substation and feeder pillar. Earth resistance shall be less than 10 ohms.

1.4.9 Testing and Commissioning

The Contractor shall perform the following tests during commissioning;

- Insulation resistance testing.
- Earth loop impedance testing.
- Continuity testing.
- Lux level verification.
- Phase balancing verification.

All test results shall be submitted to Engineer prior to energisation.

1.4.10 Document and Handover

The Contractor shall provide as-built drawings in DWG and PDF format, operation and maintenance manuals, commissioning certificates and compliance documentation.

1.5 EQUIPMENT FUNCTIONAL CONTROL

This section covers the detailed control specification of all plant equipment controlled from the MCC under Section 1.2 above. It is supplementary to and must be read in conjunction with the Functional Design Specification (FDS). The FDS is an overall process narrative, whereas this section relates only to the electrical control aspects.

This section broadly follows the plant process in sequence, grouped under the MCC and should be read in conjunction with the P&ID.

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1.5.1 General System

The principle of control is that the plant will be automated where practical, with the option of manual intervention. The general configuration is that the plant will have a MCC fitted with a PLC to control all electrically driven equipment. The information will be made available for bi-directional communications with the HMI. This will enable the works to be monitored and controlled from the MCC, or centrally from plant control room via a SCADA system, as applicable.

The MCC is also fitted with an HMI to provide a graphic representation of the plant status as well as access to the process parameters for adjustment where applicable. Status indication lights will still be provided on the MCC panels, irrespective of the HMI.

The functional description must be read within the following context:

- The Operator referenced in the FDS will be mainly in the control room, interacting with the plant via SCADA.
- In the instance where this interaction must be at the plant level, a SCADA terminal or HMI console will be provided in the plant to enable interaction with the plant, such as setting up parameters, providing control inputs and viewing status.

1.6 GENERAL ELECTRICAL INSTALLATION

The general electrical installation covers the supply, installation and connection of electrical equipment, as applicable, provided under this Contract. All work done must be in accordance with the relevant clauses, whether referenced in this section or not. Specific references are for the convenience of the Contractor and do not exclude any others.

1.6.1 Cable and Accessories

1.6.1 Cable and Wireways Installation

The Contractor must allow for the supply and installation of all necessary cables of appropriate size to all the electrical equipment.

Cable within buildings must be installed on cable ladder/tray/within conduit.

All trays must be of the heavy-duty type. In general, a tray may be used for control and instrumentation cables and power cables up to 16mm². Power cable larger than 16mm² must be installed on ladder.

Power cable in ducts buildings must be installed on horizontal cable ladder fixed to the bottom of the duct. Control and instrumentation cable must be run on separate tray/ladder vertically mounted on the duct sides.

The Equipment Coordination drawings show the position of equipment as envisaged at design stage for purposes of documentation. It is a guideline only and it will be the responsibility of the Contractor to design the wireway (cable ladder, tray conduit and ducting) installation in accordance with the equipment placement as per his tender offer and priced accordingly in the schedule of prices. There will be no adjustment to these tendered prices, except in the case where there are major equipment additions/omissions instructed by the Employer. The Contractor will be responsible to provide a functional wireway installation in accordance with the specification requirements to suit his mechanical/electrical/instrumentation installation. The Contractor must submit his design to the Engineer for comment in relation to the actual placement of equipment.

Since this is a comprehensive civil/mechanical/electrical Tender/Contract, the cost of structural openings required for wireways must be liaised between the civil and mechanical/electrical Contractors at tender stage and provided for in the tender price. At construction stage, it will be the M/E Sub-Contractor's responsibility to provide the detail of all structural openings required for wireways on the related drawings to the civil (main) Contractor before construction of the related structures. The cost for structural openings that need be made after construction of structures will be for the Contractor's account, settled between main and Sub-Contractor. No structural openings may be made in completed structures without approval of the Engineer.

Multiple multicore power cables from 25mm² and larger must be spaced with at least one cable diameter (largest cable) between adjacent cables.

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Single core power cable can be unarmoured and must be installed in trefoil. Specific care must be taken that individual cables are of equal length. Where single core cable are to be run in parallel, each group must be installed in trefoil with a neutral conductor for each group. The groups must be spaced to ensure no derating of the cable capacity is required.

A. Pricing

- Wireways: Pricing must be all-inclusive, as per the above, for each area as set out in the price schedule.

B. Cables

- Cables in the price schedule with lengths will be re-measurable and remunerated for the installed length (mainly external to buildings). Cables within buildings scheduled as sum/total (mostly within buildings) will not be re-measured and the Contractor must price these cables in accordance with the specific equipment layout.
- Cable connections

1.6.2 Earthing

The MCC must be connected to the transformer's LV earth mat by means of a 120mm² insulated copper conductor.

A 1.0 m x 1.0 m x 70 mm² bare copper earth conductor earth-mat Cadwelded with a 100 mm grid must be connected to the MCC to obtain an earth reading of one ohm or less, failing which earth spikes must be installed to obtain an earthing resistance of less than one ohm.

Earthing of equipment shall be done strictly in accordance with relevant standards. Cable rack and the pumps bases and pipe work must all be bonded to earth.

1.6.3 Local Control Station

All motor-driven equipment, except for motor-driven valves with self-contained local operating start/stop facilities, must be equipped with a local control station. The control station should have a red mushroom head emergency stop, start and stop pushbuttons, and should be mounted on a 316 SS square tubing section on a footplate, bolted to the floor in close proximity to the equipment being operated. Motorized valves must have a local control station with an emergency stop only.

Additionally, all motors should have a lockable local isolator mounted within arm's reach.

1.6.3 Building Electrical Installation

1.6.3.1 General

The project specification must be read together with the approved drawings.

The work covers the complete supply, delivery, installation and testing, commissioning, and free maintenance during the installation's guarantee period, as detailed in the specifications and accompanying drawings.

The Contractor shall provide all materials, equipment, labour and services necessary for the complete and efficient operation of the electrical installations in accordance with the intent of the specification.

The work shall be carried out strictly in accordance with:

- Client's construction and safety specifications.
- The Occupational Health and Safety Act and Regulations (Act no. 85 of 1993 as amended);
- The SANS code of Practice for Wiring of Premises, SANS 10142-1: 2020 as amended;
- Any municipal by-laws and regulations;

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- The local authority requirements

1.6.3.2 Scope

The project comprises the complete electrical installation for the new pump station and small power and lighting.

The Electrical Contractor will be responsible for the supply, delivery, installation, testing, commissioning and handing over in proper working condition of the complete new electrical installation.

The electrical work includes, but is not restricted to the following:

- a) The supply, testing and inspection at the manufacturers premises, installation, connection, testing and commissioning of distribution boards and switchgear;
- b) Supply, installation and connection of all power and lighting, distribution cabling and conductors.
- c) Supply, installation and connection of all circuit wire ways, conduit, draw and outlet boxes and sleeves.
- d) Supply, installation and connection of all circuit wiring, cables and conductors;
- e) Supply, installation and connection of all circuit equipment for power and lighting installation, i.e. socket outlets, light switches, isolators, etc.
- f) Supply and installation of all distribution panels, conduit, draw-boxes, wire-ways and accessories for the data network communications.
- g) Connection of electrical power to all mechanical equipment and systems.
- h) Supply, installation, connection and testing of an earthing system.
- i) Testing, commissioning, and handing over of the electrical installation.
- j) Testing of the new electrical installations in accordance with the requirements of the Electrical Contracting Board of South Africa and the issue of a certificate of compliance.

1.6.3.3 As Installed Drawings

A special set of all electrical drawings will be issued to the Electrical Contractor, who must keep it in a secure place in the site office. The purpose of these drawings is to update all information indicated thereon as and when any variations to the originals should occur. All updating of these drawings shall be done in red ink and shall be perfectly legible.

All relevant information regarding the installation will be clearly shown on these drawings.

Once a month these drawings will be provided to the Employer's Agent or his representative/agent for inspection and approval.

When required by the Employer's Agent or his representative/agent these drawings will be provided to him for the periodical updating of the original tender drawings.

1.6.3.4 Setting Out of Plant

The electrical Sub-Contractor shall be responsible for marking out and setting out of all equipment and plant.

The position of items of electrical equipment and plant indicated on the drawings are to be taken as approximate. The exact position for fixing shall be obtained by site measurements.

Final luminaire positions and mounting heights shall be determined by the Employer's Agent.

In case of doubt, decisions shall be obtained from the Employer's Agent or his representative/agent.

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1.6.3.5 Erection of equipment

The Electrical Contractor/ Sub Contractor shall be responsible for the erection and installation of all equipment supplied by him under the Main Contract.

In addition, the Electrical Subcontractor shall be responsible for the care and maintenance of all electrical equipment after erection is completed until the taking over of the specific section of the works. He shall ensure that the proper enclosure of all equipment is maintained at all times, that access doors and covers are opened only when necessary to work on the equipment and replaced afterwards, that the paint finish on all items is effectively protected and that all unused cable and conduit entries are effectively sealed.

1.6.3.6 Electrical Equipment

All equipment and fittings supplied and installed under this Contract, shall be in accordance with the standard and project specifications of this document.

All electrical outlets (sockets, isolators, switches, etc.) are to be labelled on the yoke, indicating circuit number and DB fed from.

1.6.3.7 Arrangement of Circuits

The arrangement of the various circuits is indicated on the drawings, together with the required protection (switchgear), control and the type and number of wiring (conductor or cable) of each circuit.

All protection shall be done with moulded case circuit breakers (MCCB's).

The fault current of the circuit breakers specified must be determined from the fault level of the DB supply source but may not be less than 6kA. The Contractor shall ensure and take care that each circuit breaker is in the correct place and position.

No mixing of different types, ratings and manufacture of switchgear shall be allowed.

1.6.3.8 Isolators Circuit Breakers and Earth Leakage Relays

Isolating switches, circuit breakers and earth leakage relays shall comply with the relevant requirements given in the standard specifications of these documents.

1.6.3.9 Drawings

The drawings generally show the scope and extent of the proposed work and shall not be considered as showing every minute detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being built in.

1.6.3.10 Testing of Installation

All tests of insulation resistance, earth continuity, earth loop impedance, and earth electrode resistance shall be made in accordance with the requirements of the Electro technical Contracting Board of South Africa as required by the OHS Act Electrical Installation Regulations of 1992, and a certificate of compliance by an accredited person, shall be issued.

The contractor will provide all test instruments and labour. Note instruments with valid calibration certificates will be used on site.

Certificates of Compliance shall be issued for work completed.

1.6.3.11 Electrical Supply

The supply cables to the building services local distribution boards are provided from the MCC distribution sections as described under the MCC construction.

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1.6.3.12 Distribution Boards

General

The distribution boards shall comply with the requirements of the standard specifications of these documents or shown on the drawings.

Drawings of the distribution boards of the manufacturer shall be submitted by the Contractor to the Employer's Agent for approval before the commencement of manufacture of any distribution boards

Installation of Distribution Boards

The distribution boards shall be installed in the positions as shown on the respective drawings. The Contractor shall ensure that the distribution boards with the necessary conduits, sleeves, and channels as required are placed in position and mounted when required, and he shall ensure that all equipment is installed in the correct positions. It must be emphasised that no chasing will be allowed in walls built with face bricks on the side in which distribution boards and ancillary equipment are installed. In all such cases the Contractor shall place his equipment in its proper place for the building Contractor to build in.

The costs of any additional work caused by late, incorrect or defective positioning of equipment and/or material by the Contractor, shall be for his own account.

The Contractor shall, while material and/or equipment forming part of the electrical installation are/is being built in and have a competent representative present to ensure that no unnecessary stress is placed on the material that will influence subsequent installation of equipment. Care shall be taken that all equipment of the board fit properly in their respective position without distortion which can lead to a poor installation and appearance. All bolts, clamps and fasteners shall be examined and properly tightened.

The Contractor shall ensure that all circuit breakers and other equipment can be changed and replaced if and when required.

All support props and struts, packing pieces and material used by the board manufacturer to prevent damage during transit, shall be removed by the Contractor. The Contractor shall examine all boards and ensure that all equipment shown on the appropriate relevant drawings has been supplied and fitted.

Any conspicuous damage like scratches or chafe marks to paint work, shall be touched up with the same colour paint as supplied by the board supplier.

The mounting height of all distribution boards, measured to the top of the edge of the board shall be 2 000 mm above finished floor level, unless otherwise specified or the position and circumstances dictate differently. The Contractor shall ensure that cables sleeves and provision for the entry of cables to distribution boards as shown on drawings are done properly and neatly.

Provision for Future Equipment;

Where space is required for future equipment, the panel shall be correctly punched for such future equipment (30% spare capacity).

Approved blank covers must be provided.

Labels

All distribution and meter boards shall be marked as follows:

- Name of distribution board, ex. "DISTRIBUTION BOARD DB-MCC";
- Origin of supply and size of all cables, ex, "Supply from the MCC , 10 mm² x 4C PVC SWA PVC";

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- All circuit breakers shall have its current rating clearly indicated on the handle, or on the panel adjacent to the switchgear;
- All circuit breakers shall be properly labelled as to its service, as indicated on the drawings.

Balancing of Load and Phases:

In multiphase distribution boards, all single-phase circuits shall be equally distributed over all three phases to balance the electrical load as far as possible.

Each type of sub-circuit shall separately be balanced over all three phases as far as possible.

Earthing:

The current carrying capacity of earth conductors shall in general be not less than 50 % of that of the largest conductor, which is protected, except that earth conductors smaller than 2,5 mm² may not be used.

All luminaires shall be earthed to an earth conductor.

1.6.4.13 Conduit and Fittings

Conduit fittings and their installation shall comply with the electrical design. Conduits shall be hot-dipped galvanised flat-ended metallic conduit and accessories when installed on the surface and is visible. In all other circumstances PVC conduit can be used.

Both concealed and surface mounted conduit and accessories installation will be applicable. The filter building and MCC room must be concealed and the balance of the pump station surface mounted.

Flush In Walls, Floors and Concealed In Roof Spaces

All concealed conduits shall be installed in concrete, chased in walls or installed in ceiling/roof spaces. All chase work and making good thereof shall form part of this Contract.

Surface Mounted In Visible / Exposed Areas

Conduit shall be fixed with suitable hot-dipped galvanised steel spacer saddles.

1.6.4.14 Wiring

Where no mention is made of conduit, the requirements shall also apply to other wire-ways such as skirting and ducting where relevant, except that these wire-ways contain more than one circuit.

All circuits in these wireways shall, however, be strapped and marked as described. Where "clean lines", i.e. separate circuits from the distribution boards, are taken to dedicated socket outlets, more than one circuit may be taken through one conduit. These cases are, however, expressly shown on the drawings, if relevant.

1.6.4.15 Mounting Heights and Positions

Mounting heights and positions of all equipment and fittings shall be as given in the standard specification of these documents and/or as given on the drawings. All cases where doubt may exist shall be referred to the Engineer for a decision.

1.6.4.16 Switched Socket Outlets

Switched socket outlets shall be 15A 3 round pin in the positions as shown on the drawings and shall comply with the requirements of the Standard Specifications of these documents.

Switches socket outlets and accessories on power skirting shall all be from one manufacture, no mixing of brands shall be allowed

- a) Dedicated switch socket outlets

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Dedicated switched socket outlets shall be provided with an isolated earth terminal, which shall not be linked to the cradle/grid earth stud. Dedicated socket outlets adjacent to data outlets shall be provided with labels (blue letters on WHITE background) "COMPUTER" which shall be fixed to the cover plate with epoxy glue and two (2) stainless steel self-tapping screws. For other dedicated socket outlets the label wording shall generally correspond with that of the distribution board circuit, but shall be confirmed and approved by the Engineer. Dedicated socket outlets on essential supply circuits shall be provided with colour blue toggles.

For each dedicated socket outlet supplied, the Contractor shall also supply a plug point.

1.6.4.17 Light Switches

Switches shall comply with the requirements of the standard specification of these documents, shall have a rating of not less than 16 A and shall be suitable to break the load which is typical of LED vapour proof luminaires.

Light switches and accessories shall be equal to the Clipsal 2000 range.

1.6.4.18 Cover Plates

Cover plates shall comply with the requirements of the standard electrical specification of these documents. Where switched socket outlets are mounted in power skirting, the cover plates shall form an integral part of the equipment in which the switch socket outlets are mounted.

Where switched socket outlets and switches are mounted in wall outlet boxes and for blank cover plates they shall be WHITE.

Cover plates shall be approved by the Engineer prior to ordering.

1.6.4.19 Power Skirting

Power skirting shall be provided in the positions and heights as indicated on the drawings and shall be complete with all outlets and accessories required.

Power skirting shall comply with the requirements of the Standard Specifications of the document.

Power skirting shall be the three-compartment 3-tier OBO Rapid 45, 2-compartment c/w partition. All sockets and device-carrying mechanisms are to fit directly into the skirting. Colour to be advised, either Grey or White.

1.6.4.20 Conduit feeders

Conduits for the circuit wiring to the power skirting shall terminate in flush conduit boxes, behind the power skirting and installed to match the height and dimensions of the skirting.

The wiring/cables shall pass through diameter openings, neatly cut in the rear of the power skirting. The holes shall be suitably bushed or trimmed to prevent damage to the wiring or cables. The Principal Contractor shall provide openings through walls, beams and slabs where required and the electrical Contractor shall timeously indicate such information to the Principal Contractor.

The Principal Contractor shall provide openings through walls, beams and slabs where required and the electrical Contractor shall timeously indicate such information to the Principal Contractor.

1.6.4.21 Luminaires

General

Luminaire positions indicated on drawings are diagrammatic, and all positions, spacing, etc. must be determined in accordance with the Engineer's detail layouts and ceiling plans.

The electrical Sub-Contractor shall check the Engineer's detail ceiling and roof layouts to ensure that all accessories, fixing details, etc. are allowed for.

Fixing Of Luminaires

Luminaires shall be installed in the position(s) indicated on the drawings. Final positions shall be determined by the Engineer.

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Supply and Installation of Luminaires

The Electrical Contractor shall allow for ordering, receiving, packing out, storing, mounting/fixing and final connections of all the luminaires indicated on the drawings in his tender price.

No luminaires shall be ordered prior to the Engineer's official written approval.

Damage To Luminaires

All luminaires damaged by the electrical Sub-Contractor or his staff before taking over shall be replaced with new luminaires at his own cost.

SANS Specification

Luminaires shall comply with the relevant SANS specification where such specification exists and shall carry the SANS mark of approval.

Where a SANS specification does not exist for complete luminaires, the accessories and control gear shall be SANS-approved and carry the SANS mark of approval.

Height Of Wall-Mounted Luminaires

The final height(s) of all wall-mounted luminaires shall be determined on site, and the Contractor shall request this information timeously from the architect or the electrical engineer via the builder. Luminaires shall be equal and similar to the manufacturer references below, and the onus will be on the Contractor to prove compliance.

Schedule of Luminaires

LUMINAIRE TYPE	DESCRIPTION (all fittings shall be fitted with surge arrestors
F1	Surface mounted LED 20W, T5 five-foot double tube each with 1800 lumen with a vapour proof fitting. IP 65 with surge protection
F2	Wall-mounted 42.8 W LED bulkhead light fitting. IP 65 with surge protection
F3	24W LED recessed panel round ceiling lights with surge protection
F4	2000W flood light, 6000k, Costal powder coated aluminium body, stainless steel bracket, bolt & screws, 4kV surge protection or better and 5-year warranty
F5	100W flood lights 5700k, Costal powder coated aluminium body, stainless steel bracket, bolt & screws, 4kV surge protection or better and 5-year warranty supplied with poles
F9	1200x 600mm LED tubes grid ceiling fittings 4kv Surge protection

1.6.4.22 "As Built" Drawings

As each portion of the work is completed, the Contractor shall provide the Engineer with "As Built" drawings showing the exact location of each outlet points, cable runs, etc. These drawings shall be drawn up by a licensed electrician and shall bear his name, signature and wireman's licence number.

In addition, a complete reticulation diagram showing all supply cables and switchboards shall be provided behind a plastic cover in M.DB.

When all the above items and the "Certificate of compliance for Electrical Installation Machinery and Occupational Safety Act 1983 (Act 6 of 1983)" Annexure 1 have been completed, and only then shall the Sub-

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Contract be considered completed and can the retention monies be reduced to 2,5% and the final certificate be issued.

1.6.4.23 Factory tests, commissioning and taking over

A full system simulation test will be required at the premises of the MCC manufacturer, to fully demonstrate the functionality and communication of the comprehensive system.

Taking over inspection will only be arranged after total completion and successful commissioning by the Contractor and subsequent one hundred percent trouble free operation of the comprehensive system for fourteen consecutive days and submission of the Operation and Maintenance Manuals. Completion (taking over) will not be given without the manuals.

No remedial work will be entertained concurrent with the taking over inspection, i.e. after any remedial work before taking over, the system must operate for fourteen consecutive days' trouble free, before the Engineer is called out for taking over inspection.

1.7 INDUSTRIAL NETWORKS

1.7.1 Copper Network (100base-tx)

Cable

All copper communication cable required in the site network shall be of the CAT6 overall shielded twisted pair type (S/UTP), minimum IP65 rated. Note the importance of the bending radius of a minimum of 4 x times the cable diameter, which may not be exceeded. Non-compliance will result in the complete replacement of the affected cable with a new cable. Re-routing of the stressed cable will not be accepted.

The cable transmission performance must comply with TIA/EIA 568, and the cable marking requirements in compliance with the EC VERIFIED requirements.

Cable runs may not exceed 90m in length (total). In the case where there is no alternative but to exceed this distance, an additional enclosure with a repeater/switch, must be provided as part of the tender offer. All cable runs between equipment termination points must be continuous and joints or splices will not be accepted.

All S/UTP cables must be installed on a cable ladder/tray sized for the related number of cables and may not be installed underground. Single cable runs must be installed within surface mounted hot dipped galvanized conduit. The drawings indicate functional requirements and positions of equipment. Cable and cable ladder/tray routes shown are nominal. The final routing on-site will be the responsibility of the Contractor, including the related cable tray and/or conduit planning and installation. Final routes must be carefully planned that network and power cables do not run in close proximity to one another to prevent interference, and crossing must be avoided. Where a power-cable crossing is unavoidable, it must be at right angles to the network cable, which must be installed in a section of steel conduit. All external cable tray routes against structures must be provided with additional cable tray cover, fastened with stainless steel bandit straps.

For horizontal runs, S/UTP cables must be strapped together every 1-meter (maximum) on the cable tray. All vertical S/UTP cable runs must be securely strapped every 300mm (maximum), but care must be taken that the cables are not strapped too tight, placing unnecessary strain on the cables.

Note that the shielding must be connected to the network switch and not the field device, which in turn must be properly earthed in order to eliminate any ground potential differences.

The Civil Contractor will provide all structural openings required for cable runs. The Contractor for this section must plan his routes well in advance of the related building structure construction and provide drawings of all his required wall/floor-slab/soffit structural openings to the civil Contractor to make appropriate provision. Any additional access openings required after completion of the structure will be for the account of the Contractor under this section, unless caused by changes out of his control. No core-drilling or making an opening a structure by any means will be allowed without the written permission of the structural Engineer.

All S/UTP cables must be clearly marked at both ends with both source and destination labels (i.e., patch panel switch number as source and remote I/O module number as destination. Cable connections at the various

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switches and modules must be via industrial RJ45 connections, in accordance with the TIA/EIA-568 standards. Only shielded RJ45 connectors may be used.

Network Switches and Related Devices

Switches must be of the managed, Fast-Ethernet (Ethernet/IP) type, in order to provide for the RSTP, ring-redundancy functionality, in compliance with IEEE 802 and applicable sub-regulations. Each switch must act as a ring manager, checking the integrity of the ring and opening and closing where required. Precise time synchronization of the networks is essential. The switches offered must have an industry-rated MTBF.

Switches must be of the robust industrial type, suitable for an environment with dust, vibration and Electro Magnetic Interference (EMI). The number and type of ports required must be determined by the Contractor in conjunction with the functional drawings and specifications, inclusive of additional 30% spare capacity. Power supply must be provided as per 1.3 above. A RJ45 connection must also be available for local laptop access.

Network switches must be installed within the MCCs' PLC control section. In instances where there is no PLC or MCC, the switch must be installed within the remote I/O or fibre optic termination cabinet. A clear earth path must be created along with the S/UTP cable, to prevent any ground potential differences.

Switches must be forward DIN Rail mounted in MCC and rack-mounted in remote I/O or fibre termination cabinets. DIN Rail will also be acceptable, provided that the switch is brought forward in the cabinet for ease of access and maintenance.

Note that a switch and media converter may be one combined unit, but this configuration must be applied throughout the plant. Refer media converters below in section 4.5.3.

Switches must be labelled in a logical manner, in conjunction within the areas that they are located. The numbering system must correlate with the S/UTP cables connected to the switch.

The necessary conversion modules must be provided as interface between the Ethernet switches and supplementary networks/dedicated field buses, to ensure seamless data transfer from these field devices via the Ethernet network to the PLC and SCADA system.

Remote I/O

Where multiple I/O are located in close proximity in the plant some distance away from the related PLC, remote I/O modules must be provided. Remote I/O modules must be of the same manufacture and type as the PLC and related equipment installed within the MCC. These modules must be connected to a local switch via an S/UTP cable, and must be compatible in terms of communication requirements. Note that the specification allows for low-level communication systems for specific plant areas as an alternative to remote I/O, but only where specifically stated as such.

All field equipment must be wired to interface terminals within the enclosure, housing the remote I/O module(s). These interface terminals must be permanently and dedicatedly wired to the respective remote I/O cards, based upon the requirements as per the instrumentation and control specification. Spare space provision of 30% must be allowed for at both the terminals and within the I/O modules. These spare terminals must be fully wired up to the modules.

All terminals and wires must be clearly and logically labelled in accordance with the system referred to under the scope. All wire numbering must be included onto the final wiring diagrams, which must be submitted with the operating and maintenance manuals.

In the case of remote intelligent devices with a network connection, these devices must be connected to the network switch in the remote I/O panel closest to the device(s), or in absence, a dedicated switch panel must be provided in the case of multiple devices in close proximity of each other. The necessary conversion modules must be provided for devices operating on a dedicated fieldbus other than Ethernet.

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PLC Interaction

The plant must be provided with PLC as specified under the related sections, to provide for the required monitoring and control as per the control specification. The interaction between the PLC and network backbone is critical in maintaining data integrity, to prevent loss of data for logging on the central SCADA system and for inter-connected control signal relaying.

Testing and Calibration

Every installed circuit (live and redundant) must be tested by the Contractor during the commissioning stage of the project. The testing shall be carried out with a field tester conforming to TIA/EIA 568 criteria. Each circuit must be tested end to end, including all leads. All results must be clearly documented and included as part of the final operating and maintenance manuals.

Note that all testers used must be accompanied by their respective calibration certificates from the manufacturer, to be presented to the Engineer on request. No calibration certificate, at the time of cold commissioning, may be more than 1-year old.

1.7.2 Fibre-optic network (100base-sx)

A fibre-optic network must be provided for the intended works, as described in this section of the specification.

The equipment supplier and installer must have proven capabilities in this field and have a track record of work previously done, similar to the work covered by this project. A summary of such work must be included with the tender with contactable references. Refer to the data sheets.

1.7.3 Cable Work

Fibre optic (FO) cable must be of the 50/125µ armoured, multi-mode type consisting of 4 pairs.

- Installation

All outdoor FO cable must be installed in a 110 mm diameter corrugated PVC sleeve, which must be supplied and installed under this Contract. All other FO cable must be installed either on a separate section of cable tray, or combined with the copper network tray. For horizontal runs, FO cables must be strapped together every 1-meter (maximum) on the cable tray. All vertical FO cable runs must be securely strapped every 500 mm (maximum), but care must be taken that the cables are not strapped too tight, placing unnecessary strain on the cables.

A manhole (draw-pit) must be provided at each bending point along the route, after each 200m (provisional) straight length of the route (the Contractor must confirm the maximum permissible distance between manholes and adjust the installation accordingly) and where cable joints are required. The manholes must be minimum 600mmx 600mm, concrete type, with lockable lids and completely sealed to any water or particle ingress. The Contractor must provide the construction detail of this manhole to the Engineer for approval, prior to construction. All manholes and associated civil work must be priced for under this Contract, including construction design and monitoring.

The Contractor can utilize the pump station civil Contractor for the civil work, if so required, but overall responsibility will remain with the FO designer and eventual installer. All civil designs must be submitted to the Engineer for comment before installation may commence.

Cable for extended outdoor runs, must be installed in maximum continuous lengths, to minimise joints and delivered in drum lengths of 4 000 to 6 000 m nominally, (not less than 3 000m except where the total continuous run is less, which will then determine the drum length) and cut lengths for intermediate/end sections. Joints in the cable for extended continuous runs of less than the delivery lengths will not be allowed. The drawings indicate functional routes on scale, from which distances can be determined. However, lengths derived from these distances are for tender purposes only and the lengths for ordering must be measured on site, inclusive of slack and loops. Remuneration will be for the installed length at the tendered rate per meter, measured linearly from point to point, including loops at agreed fixed length per loop. Slack must be allowed for in the rate.

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Care must be taken, especially at the draw-pits and jointing chambers, when installing the FO cable. Minimum tension must be applied and rollers must be used to this effect, to prevent any damage to the outer sheath (no mechanical or other devices may be used, unless approved by the supplier). Note the importance of the bending radius requirements of the supplier, which may not be exceeded. Should this be the case, a new cable for that section must be provided. No re-adjustment of the cable will be accepted.

A 1.0 m cable loop must be left at each draw-pit and 1.5 m at each jointing chamber and end connection.

All ancillaries such as cable tray, brackets and supports must be priced under the respective BOQ items. Note the requirements in section 1.1 above relating to access into buildings, routes etc. These requirements are applicable in this fibre application as well.

All FO cables must be clearly marked at both ends with both source and destination labels (i.e., patch panel #XX number as source and patch panel #YY number as destination) in accordance with a system to be agreed with the Employer's Agent.

- Joints

Cable joints must be made inside a jointing chamber as per the above, within a watertight jointing box wall-mounted against the chamber structure wall. A 1.5 m cable loop must be left in each jointing chamber fixed to a hanger. Each cable end must be provided with a source and destination tag, as per the labelling requirements above.

The jointing box for splicing and through connection of the FO cable must be of the polycarbonate type with clear see-through lid rated at IP65. It must be fitted with a patch panel and the cables terminated.

- Inspections

The cable must be inspected and quality tested at the factory prior to dispatch. After delivery on site and prior to installation, the drum(s) must be visually inspected for damage and Optical Time Delay Refractive (OTDR) drum tests must be done on all cores. The factory must provide the necessary quality and test certification and the Contractor must provide the on-site drum test certification. All certificates must form part of the formal submitted documentation.

Should any damage be detected, the drum must be replaced in whole. Protective caps should be fitted to protect exposed fibres at all times.

- Indoor Termination Cabinets

Patch Panel and Terminations

All cables must be properly terminated onto a rack-mounted patch panel at each point where the fibre optic cable network must be accessed, primarily at each PLC and at plant sections where there is a copper/fibre interface. Each patch panel must be installed within a dedicated fibre-optic termination cabinet and provided complete with adaptor plates suited to connectors, splice trays and fibre optic pigtails.

A minimum of a 0.5 m unjacketed fibre pigtail must be provided at each fibre patch panel. The cables must be securely fastened, so that during maintenance, the cables cannot move. All the cores in the cables must be spliced and connected and all unused slots on the patch panel must be loaded with blanks so as to ensure the IP rating. All unused fibres must be sealed with a mid-coupler end protection cap.

The ports in the panel must be numbered numerically from left to right. Each cable must be provided with a source/destination tag.

All patch panels must be assembled in the factory and inspected by the Engineer, before being taken to site. No assembly will be allowed on-site.

Media Converter

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A media converter must be provided as an interface between the copper and fibre network at each point where there is a transition. The media converter must be of the DIN rail type and provision must be made within the termination cabinet. Switched media converters will not be acceptable.

Note that should a network switch and media converter be one combined unit, the same philosophy must be applied throughout the plant.

Cabinet

The patch panel and media converter must be housed within an IP 65 rated purpose built wall mounted steel cabinet with lockable hinged door with glass window. Long base brush panels must be installed in each cabinet. The mounting rails must be back and front adjustable. Two fans must be provided within the cabinet, with the Contractor design ensuring adequate air-flow for the equipment. The panel must be fitted with a main CB and the necessary distribution CBs for all equipment supplied from the cabinet (note the COC requirements in terms of SANS 10142-1).

Adequate space must be provided within the enclosure for ease of access and maintenance and all required equipment for that specific section of the works. Note that an additional 30% spare space capacity must be allowed for in the final sizing of the cabinet. Note the requirements with regards to the housing of switches, where there is no MCC in the vicinity.

Each enclosure must be suitably and permanently labelled, with consistency provided throughout the works. In addition, each enclosure must be provided with a laser light warning label.

Size 0 compression glands must be used for fibre cable entry into the cabinets (onto gland plate), and size 00 for copper Ethernet cables. All drilling and taping must take place on the backing/mounting plate of the enclosure. No double-sided tape or side-panel taping will be allowed.

- Testing and Calibration

On completion of the installation, the final FO cable tests must be done for all the cores (for example, dB losses and ensuring optical continuity throughout).

Note that all OTDR testers used must be accompanied by their respective calibration certificates from the manufacturer, to be presented to the Engineer if so required. No calibration certificate, at the time of cold commissioning, may be more than 1-year old

1.8 PROCESS AND INSTRUMENTATION

1.8.1 Scope

This section of the Contract covers the instrumentation installation at the plant. This specification must be read in conjunction with the FDS and all the other sections of the specification, especially The Electrical Section dealing with the functional control of the plant and the FDS for the application narrative.

All remote mounted instrumentation must be installed in a suitable enclosure.

The Contractor shall provide the following:

- Programmable Logic Controller (PLC)
- Human Machine Interfaces (HMI)
- Configuration of SCADA system at the Plant
- Instrumentation
- Instrumentation and control component earthing and surge protection systems
- Control & instrumentation cabling and cable supports
- Testing and commissioning of control and instrumentation installation.

Pricing:

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Note that although the device type is referenced to the P&ID measurement element, the item price tendered in the price schedule must provide for the comprehensive instrumentation inclusive of the related transmitter, display and associated enclosure and mounting accessories.

1.8.2 Lighting and Surge Protection

Fuses and Surge Protection Devices (SPDs) shall be provided on the power supplies to all electronic equipment and instrumentation as well as on all the outdoor instrument signal loops.

1.8.3 Control Cables

Control cables shall be 600/1000V multicore 1.5 mm² standard copper conductors. PVC-insulated cables with galvanised steel wire armouring and PVC serving.

Multicore cables shall be used to group the control signals of each pump set and relay them to the PLC via a junction box.

1.8.4 Instrumentation and Control Junction Boxes

An instrument and control cable junction box shall be supplied for each driven load. This junction box shall also serve as the field control station.

The junction box shall provide for cabling termination and marshalling of all motor and pump winding, bearing temperature and vibration transmitter/data loggers, pressure and flow signals.

The junction boxes shall be pedestal mounted, adjacent to the electric motor as indicated in electrical drawings.

1.8.5 Data Cables

The following cables shall be provided for the control system and links to the associated equipment:

- PLC to VSDs: Cat 6
- PLC to Vibration controller: Cat 6.
- PLC to Power Meter: Cat 6 or fieldbus cable
- Fibre Optic Cable.
- PLC to flow meters: fieldbus cable.

1.8.6 Programmable Logic Controller

1.8.6.1 General

The PLC shall execute the FDS as described in relevant sections.

The Employer shall produce a control system functional design specification (FDS). This document shall be issued once the Contract is awarded. During the detailed design the Contractor shall update this document to suite his design and equipment selection.

1.8.6.2 Inputs and Outputs

The I/O list shall be finalised by the Contractor during the Contract and shall be submitted for approval by the Engineer before final design and programming of the PLC.

Digital input / output cards shall be 24 VDC and analogue input / output cards 4- 20mA current loops where signals from conventional process instrumentation are required.

The input / output modules shall be provided with their own power supply independent from the CPU power supplies.

Loop isolators shall be provided on all analogue inputs to the PLC.

1.8.6.3 Communication Protocols

The following communication shall be utilised:

- PLC to reservoirs RTU: Ethernet (fibre optic).
- PLC to HMI: fieldbus or Ethernet.
- PLC to VSD: Ethernet.
- PLC to power meter: Ethernet

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- PLC to Field Instruments: fieldbus and/or Ethernet
- PLC to Central SCADA: fibre optic.

1.8.6.4 Programmable Logic Controller Panel

- The PLC panel shall be installed in the MCC room.
- The panel shall house the PLC, HMI, dc power supplies, instrument distribution, batteries and battery charger.
- The PLC panel shall also serve as a marshalling panel for field instrumentation with the right side of the panel being used for this purpose.
- The panel shall be of similar materials and dimensions as the MCC and shall be installed adjacent to the MCC.
- The panel shall be floor standing.
- Full-length doors shall be fitted to the front of the PLC panels and the front doors armour-plated glass windows for viewing the status of the PLC; all as indicated on the MCC/PLC panel General Arrangement Drawing.

1.8.6.5 Human Machine Interface (HMI)

A graphical human machine interface (HMI) shall be provided on the PLC panel. The HMI shall be configured to provide the operator with equipment control and status information, alarm lists, graphical trends and data logging.

The HMI shall also allow control parameter changes to the PLC, which shall be password protected and logged. Operator actions, selections or setting updates described in the control philosophy shall be possible via the HMI interface.

The HMIs shall be configured with a simple default graphic display (mimic) showing all relevant equipment of the plant and reservoirs, its status (running, tripped or stopped) and instantaneous and totalised instrument readings.

Mode selection on related electrical equipment (e.g. motor starters, control system mode, etc.) shall be clearly indicated on the HMI.

Status shall be indicated by different state colours (such as white for ready, green for running, amber for tripped and red for 'E-stop' or other fault states).

A trending page shall be provided showing all measured value readings over time. The trend page shall show live and historical data (which shall be logged to the HMI memory in a first in first out rolling log file). Trends shall be configured to show an hourly interval of readings.

An alarm page shall be provided showing all outgoing and incoming alarms. Alarms shall also be stored in a first in first out file stored in the HMI memory. It shall be possible to scroll backward and forward in the alarm list.

1.8.6.6 Testing and Commissioning

The Contractor shall allow for testing and simulation of the control system and its associated SCADA/HMI to be witnessed by the Engineer

1.9 INSTRUMENTATION INSTALLATION

1.9.1 General

Contractor shall provide instrumentation as indicated on the Process and Instrumentation Diagram and FDS.

1.9.2 Detail Requirements

Outdoor mounted transmitter units of instruments at the plant shall be installed in a 3CR12 weatherproof enclosure or in the PLC panels (where applicable).

Field instrumentation shall be connected to the PLC as specified in relevant sections.

Transmitter enclosures shall be pedestal or wall mounted, in an area that ensures easy viewing of the display and is accessible to operators.

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1.9.3 Flow Meter

Wetted ultrasonic flow meters shall be provided under this contract. It shall be installed as indicated in the P&IDs. The flow meters shall provide hardwired no-flow protection.

1.9.4 Testing and Commissioning

The following checks shall be done to ensure that the PLC and SCADA operate as required:

- Equipment safety is checked, this also includes emergency stops.
- The PLC code, SCADA and associated software operate as required.
- The used equipment is installed according to specifications.
- Inputs and outputs are connected according to drawings.
- Calibration of equipment is correct.
- Trip points operate according to the requirements.
- The outputs actions are as intended.
- The alarms operate accordingly.
- Operator functions are according to the specifications.

Each stage of the testing is to be detailed in the:

- Factory Acceptance Testing (FAT)
- Site Acceptance Testing (SAT)

1.9.5 SCADA

1.9.5.1 General

The Contractor shall use the FDS produced by the Employer to base his SCADA mimics on. The Contractor shall allow for a meeting with the Employer and the Engineer to discuss the proposed displays and mimics, and shall thereafter configure the system to the agreed requirements.

The SCADA system shall allow monitoring and control of the pumping scheme. Control shall be password protected.

1.9.5.2 SCADA Application Software

The Contractor shall allow for the addition of the plant mimics to the new master SCADA station. Sufficient software tags are available for the plant mimics.

Mimics, trending and alarms at the master SCADA station shall be updated to show the plant.

The Contractor shall derive all tags necessary for the SCADA system to display, monitor, log, trend and record all information from the pumping scheme.

1.9.5.3 SCADA Mimics

An overview of the complete pumping system shall be programmed as well as detailed mimics of plant's equipment.

A mimic shall also be provided to indicate the status of all communications networks.

A navigation screen on the overview mimic shall be provided from where the operator can navigate from the overview to detailed screens of the equipment and instrumentation.

Historical and real-time trending shall be provided for the following:

- Flow measurements
- Energy Consumption

All motor trip conditions and faults will be sent to the SCADA alarming system and all operator actions to start, stop, reset and change pumps parameters will be event-logged on the SCADA.

A set of reports shall be configured on the SCADA to indicate the following:

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- Flow (instantaneous and totalised) and level instrument analogue values
- Pump set maximum, average, minimum amps.
- Pump run hours and down time.
- Alarms
- Electrical Consumption

Maintenance requirements and status (includes last service/maintenance date, who performed service and details of maintenance; next service/maintenance date).

- Reporting data shall be stored in the existing database.
- The reporting software shall be configured to store high resolution data for 3 months after which the data will be aggregated stored for at least 3 years.

1.9.6 Pump-Motor Set Protection

The pump sets must be protected, against damage for the conditions described below.

1.9.6.1 Motor Protection

- a) Motor comprehensive protection, integral to the VSD.
- b) Phase fail / under voltage.
- c) Motor winding overheat by means of PT100 temperature sensors (two per phase). Each phase must be provided with an adjustable (via HMI and SCADA) alarm and trip setting.
- d) Restart delay: to prevent consecutive starting within a pre-set time (set on HMI AND SCADA).
- e) Bearing over temperature by means of PT 100 temperature sensors, both for the drive end and non-drive end. Each bearing must be provided with an adjustable (via HMI and SCADA) alarm and trip setting.
- f) Bearing vibration (vibration sensor with analogue output and programmable alarm and trip limits).
- g) Motor shaft induced voltages.

1.9.6.2 Pump Protection

- a) Pump running dry by means of a non-intrusive type flow switch in the outlet from each pump. Timers must be provided to over-ride this switch during start-up, stopping and short time disturbances. This timer must be coordinated with the ramping up and down times, to prevent nuisance tripping.

Backup protection must be provided via the VSD undercurrent protection, subject to the same time coordination as for the flow switches.

- b) Low suction pressure by means of an adjustable pressure switch in each pump suction line.
- c) High delivery pressure by means of an adjustable pressure switch in each pump delivery line
- d) Low delivery pressure as sensed by a pressure sensor in the common delivery line.
- e) Delivery high flow. The delivery line flow meter must be monitored and alarm and trip settings must be provided, for each pump, the alarm value to be set at 90 % of the maximum safe flow of the pump and the trip value set at 110 % of the maximum safe flow. The relevant flow must be present for 10 s, before the alarm/trip condition is accepted.
- f) Shaft induced voltages.

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1.9.6.3 Pressure Sensing

The pumps common suction and delivery lines pressure must be continuously monitored for by means of pressure sensors. An alarm must be generated on HMI and SCADA if pre-set pressure values are exceeded.

- Low suction.
- High delivery.
- Low delivery.

1.9.6.4 Alarm And Status Indication Facilities

- (a) Main Pump panel
 - RUN
 - VSD TRIP
 - NO FLOW
 - SUCTION PRESSURE LOW
 - DELIVERY PRESSURE HIGH
 - E-STOP ACTIVATED
 - START LIMIT FAULT
- (b) Control panel
 - SUCTION PRESSURE dynamic display.
 - DELIVERY PRESSURE dynamic display.
 - DELIVERY FLOW dynamic display.
 - DELIVERY PRESSURE HIGH.
 - DELIVERY PRESSURE LOW.
 - SUCTION PRESSURE LOW.
 - DELIVERY FLOW HIGH
- (c) HMI and SCADA
 - As for (a) and (b) above
 - Suction pressure dynamic display
 - Delivery pressure dynamic display
 - Delivery flow dynamic display

1.1.0 DATASHEETS

A. DATA SHEET FOR MOTOR CONTROL CENTRE (MCC)

Item	Description	Designer	Tenderer's Deviation
1.	General requirements		
1.1	Design Standard	IEC 61439	
1.2	Rated Nominal voltage	400V	
1.3	Maximum Voltage	420V	
1.4	Overvoltage Category	III	
1.5	Insulation (Power Frequency voltage)	1000V	
1.6	Insulation (Lightning Impulse)	Vendor to specify	
1.7	System configuration	4 Wire + Earth	
1.8	System Earthing	Solidly earthed	
1.9	Switchgear Coordination	Type 2	
1.10	Pollution Degree	3	

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 DAM

1.11	EMC Environment	Vendor to Specify	
1.12	Type Tested	Type 2 Normal Start IEC 60947-4-1	
1.13	Rated Control Voltage: Relays, field control, lights, metres etc.	230VAC	
1.14	Rated Control Voltage: Contractor coils, larger fans, etc.	230VAC	
1.15	Rated Current (Main Busbar)	2000A	
1.16	Rated Prospective Fault Current	50kA	
1.17	Rated frequency	50Hz	
1.18	Rating of Main Power Transformer	1000kVA	
1.19	Access to MCC	Front & Back	
1.20	Material of Construction	3CR12	
1.21	MCC Fixed or Moveable	Fixed	
1.22	Coating System	Powder Coating	
1.23	Full Discrimination for Overload Conditions	Yes	
1.24	Full Discrimination for Fault Conditions	Yes	
2.	Limiting Dimensions		
2.1	Overall length	600mm wide per tier, 800mm for incomer, 350mm for wireways, 6850mm overall length	
2.2	Overall Height	2100mm	
2.3	Depth Front to back	600mm	
3.	Paint Colours		
3.1	Exterior	B26-Electric Orange	
3.2	Interior	B26-Electric Orange	
3.3	Front Access Doors	B26-Electric Orange	
4.	Degree of Protection - Closed		
4.1	Indoor MCC	IP42 minimum	
5.	Degree of Protection - Open		
5.1	Indoor MCC	IP42 minimum	

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6.	Form of Internal Separation		
6.1	Main Incomer	Form 4A	
6.2	Functional Units	Form 4A	
7.	Direction of Cable Entry		
7.1	Top	N/A	
Item	Description	Designer	Tender
7.2	Bottom	Bottom entry	
8.	Main Incoming Circuit Breaker		
8.1	Location Within MCC:		
8.1.1	Left End	Yes	
8.1.2	Right End	No	
8.1.3	Centre	No	
8.2	Type of Breaker:		
8.2.1	Fixed - motorised	Yes	
8.2.2	Fixed Pattern	Yes	
8.2.3	Continuous Current Rating	1600A	
8.2.4	Communications	Yes	
8.2.5	Measurement Module	Yes	
9.	Instruments on Panel		
9.1	Incomer		
9.1.1	Panel view		
9.1.1.1	Installed	Yes	
9.1.1.2	Make and Model	Vendor to Specify	
9.1.2	Ammeters		
9.1.2.1	Make and Model	Vendor to Specify	
9.1.2.2	Installed and Quantity	Yes, one per phase	
9.1.2.3	Measurements	Instantaneous, Thermal and Maximum Demand	
9.1.3	Voltmeters:		
9.1.3.1	Make and Model	Vendor to Specify	
9.1.3.2	Installed and Quantity	Yes, 4	
9.1.4	Power Quality Meter		
9.1.4.1	Type, Make and Model	Vendor to Specify	

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9.1.4.2	Remote Monitoring	Yes	
9.1.4.3	kWh Pulses	Yes	
9.1.4.4	Communication Link	Yes, Ethernet IP	
9.1.5	Stand-Off Switch (Pendant)		
9.1.5.1	Installed	No	
9.1.5.2	Make and Model	N/A	
9.2	Outgoing Circuits		
9.2.1	Ammeters		
9.2.1.1	Make and Model	Vendor to Specify	
9.2.1.2	Installed and Quantity	Yes, one per phase	
9.2.1.3	Measurements	Instantaneous, Thermal and Maximum Demand	
9.2.2	Indication Lights		
9.2.2.1	Make and Model	LED cluster type	
9.2.2.2	Quantity	3	
9.2.2.3	Colour	Run-Green, Stopped-Red, Fault- Amber	
9.2.2.4	Local and Remote Switch	Yes	
10.	Bus-Section Switches		
10.1	Number to be Provided	N/A	
10.2	Method of Interlocking:		
10.2.1	Substation	N/A	
Item	Description	Designer	Tender
10.2.2	Fortress Key - between changeover panel and MCC Incomer	N/A	
10.2.3	Electrical	N/A	
11.	Incoming Cables From the Distribution Transformers		
11.1	Insulation Material	PP/EMC/Double Screening	
11.2	Type of Cable	PVC/SWA	
11.3	No. Of Cables		
11.3.1	In Parallel (4C Cables)	2	
12.	Marshalling Compartment		

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12.1	Marshalling Compartment Required	Yes	
13.	Control Supply		
13.1	230V AC:		
13.1.1	Make and Model and Running	Vendor to Specify	
13.1.2	Power Supply in MCC	Yes	
13.1.3	External Source	No	
13.1.4	UPS/ Inverter in MCC	Yes	
14.	Control System		
14.1	Control Via PLC	Yes	
14.2	PLC Power Supply Required	Yes	
14.3	PLC Supply Voltage	230VAC/24VDC	
14.4	Power Supply in MCC	Yes	
14.5	UPS Located in MCC, Feeding PLC	No	
14.6	UPS Requirements	Vendor to specify	
15.	Motor Protection Relay		
15.1	Motor Protection Relay Requirements	VSD's and Intelligent motor protection relay with network capabilities to connect to the PLC	
15.2	Make and Model	Vendor to Specify	
15.3	Fieldbus Network Required/type	Yes Vendor to Specify	
15.4	Network Topology	Ring Topology	
16.	Arc Flash		
16.1	Must Assembly be Tested	Yes (to SANS 61641)	
16.2	Must Assembly be Tested for Equipment Damage	Yes	
16.3	Must Assembly Tested for Personnel Injury	Yes	
16.4	Areas that must be tested	All	
17.	Special requirements		

B. DATA SHEET FOR VARIABLE SPEED DRIVES

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 DAM

Item	Description	Designer	Tender
1	General requirements		
1.1	Manufacture and Model	Vendor to specify	
1.2	Type	Voltage Source, Sensor-less Vector or Similar	
1.3	Voltage rating	400V	
1.4	Current rating	280A	
1.5	Power rating	160kW	
1.6	Speed range	0-100Hz	
1.7	Cooling (Forced, Natural)	Forced	
1.8	Altitude De-Rating	1500m ASL	
1.9	Prospective Symmetrical 3-phase fault level	50kA	
1.10	Prospective single line to earth fault level	50kA	
1.11	Type of protection (MCCB, Vacuum CB etc.)	MCCB	
1.12	Protection details (Make, Model Number etc.)	Vendor to specify	
2.	Limiting Dimensions		
2.1	Overall Length	Vendor to specify	
2.2	Overall Height	Vendor to specify	
2.3	Depth front to back	Vendor to specify	
3.	Electrical Details		
3.1	Supply Voltage (400V $\pm$ 10%)	Yes	
3.2	Supply System Earthing	Solidly Earthed	
3.3	Field Control Voltage	VAC	
4.	VSD Control Voltage		
4.1	230V AC derived from main power	Yes	
4.2	230V AC derived from external source	No	
4.3	Heat Dissipation	Vendor to specify	
4.4	Anti-condensation heaters	Vendor to specify	
5.	Filters and Harmonics		

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5.1	Input Choke	Yes	
5.2	DC Link Choke	Vendor to specify	
5.3	Output Choke Filters	Vendor to specify	
5.4	Active Harmonic Filter	Yes	
5.5	Motor Cable Details and Length	3C 95mm ² + E, 120m maximum	
6.	Input Harmonic Currents		
6.1	5th		
6.2	7th		
6.3	11th		
6.4	13th		
6.5	17th		
6.6	19th		
6.7	23th		
6.8	25th		
6.9	29th		
Item	Description	Designer	Tender
6.10	31th		
6.11	35th		
6.12	37th		
6.13	41th		
6.14	43th		
6.15	47th		
6.16	49th		
7.	Active Harmonic Filter		
7.1	Total Harmonic Distortion at 40% Load	<8%	
7.2	Total Harmonic Distortion at 70% Load	<7%	
7.3	Total Harmonic Distortion at 100% Load	<5%	
7.4	Efficiency at 100% Load	>98%	
7.5	True Power Factor at 40% Load	>80%	
7.6	True Power Factor at 70% Load	>95%	

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7.7	True Power Factor at 100% Load	>98%	
7.8	Ambient Temperature Without Derating	45°C	
7.9	Cooling	Vendor to specify	
8.	Control		
8.1	Mode (Speed or Torque)	Speed	
8.2	Field Bus	Ethernet	
8.3	Drive Inhibit	D/I	
8.4	Set Point Local/Remote Selector	Door mounted local control mode	
8.5	Set Point Local Control	Door mounted local control mode	
8.6	Remote START/STOP	Field Bus	
8.7	Local START/STOP	Door Mounted Control Panel	
8.8	E-Stop	Door mounted Mushroom Head Lock Stop. Main Contactor to drop out	
8.9	Local Fault Reset	Door Mounted Control Panel. Resetting VDS will not start Pump until start signal is received from PLC	
9.	Protection		
9.1	MCCB	Yes	
9.2	Main Isolator and Fuses Combination Unit	No	
9.3	Thermal Overload Protection	Yes	
9.4	Main Contactor	Yes	
9.5	Overcurrent	Yes	
9.6	Stall	Yes	
9.7	Motor Temperature Detectors Trip Thermistor Relay/RTD	Yes Thermistor (Wired to PLC and not Drive)	
9.8	Power Stack Thermal Trip	Yes	
Item	Description	Designer	Tender

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9.9	Phase Loss Trip	Yes	
9.10	Phase Rotation Trip	Yes	
9.11	Encoder Fail Trip	Yes	
9.12	Over Speed Trip	Yes	
9.13	Over Voltage Trip	Yes	
9.14	Under Voltage Trip	Yes	
9.15	Do/dt	Yes	
9.16	Di/dt	Yes	
9.17	Transient Protection	Yes	
9.18	Semiconductor Trigger Failure	Yes	
9.19	Motor Cooling Failure	n/a	
9.20	Comms Failure	Yes	
10.	Local Indication		
10.1	Local Current/Power	Yes, LCD	
10.2	Frequency/Speed	Yes, LCD	
10.3	Power On	Yes, LCD	
10.4	Drive Ready	Yes, LCD	
10.5	Drive Run	Yes, LCD	
10.6	Drive Fault	Yes, LCD	
10.7	Motor Cooling Fan Failure	Yes, LCD	
10.8	Other	Local/Remote Control	
11.	Remote Indication - Field Bus		
11.1	Mains On	Yes	
11.2	Control On	Yes	
11.3	Drive Running	Yes	
11.4	Drive Ready	Yes	
11.5	Frequency/Speed	Yes	
11.6	Load Current	Yes	
11.7	Drive in Local/Remote	Yes	
11.8	Drive Fault	Yes	
11.9	Field Status	Yes	
11.10	Start	Yes	

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11.11	Stop	Yes	
11.12	Local/Remote	Yes	
11.13	E-Stop	Yes	
12.	Local Fault Indication		
12.1	Over Current	Yes, LCD	
12.2	Under Current	Yes, LCD	
12.3	Under Voltage	Yes, LCD	
12.4	Fuse Failure	Yes, LCD	
12.5	Stall	Yes, LCD	
12.6	Over Temperature	Yes, LCD	
12.7	Semiconductor Failure	Yes, LCD	
12.8	Processor Failure	Yes, LCD	
12.9	External Interlock	Yes, LCD	
12.10	First Fault	Yes, LCD	
12.11	Comms Failure	Yes, LCD	
12.12	Other (Fault Memory Buffer)	Yes, LCD	
13.	Commissioning/Programming		
13.1	Software	Yes	
13.2	Communication Cable	Yes	
Item	Description	Designer	Tender
13.3	Length of Communication Cable	Vendor to specify	
13.4	Communication Module/Card	Yes	
14.	Access to Communication Port		
14.1	On VSD in Panel	Yes	
14.2	On front access door of enclosure	No	
14.3	Both on VSD and front access door	No	
15.	Physical Details		
15.1	Enclosure Degree of Protection	IP 2X	
15.2	Free Standing, Bucket Mount, Wall Mount	Bucket Mount	
15.3	Cable Entry	Bottom	

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15.5	Overall Dimensions (WxHxD)	Vendor to specify	
15.6	Ventilation Design	Vendor to specify	
15.7	Weight	Vendor to specify	
16.	Other Details		
16.1	Tag Details	Yes	

C. DATA SHEET FOR CABLES			
Item	Description	Designer	Tender
1.	Power Cables LV		
1.1	Manufacture	Vendor to specify	
1.2	Type	PVC insulated and PVC bedded, steel wire armoured, PVC sheathed	
4.	Instrumentation Cables		
4.1	Manufacturer	Vendor to specify	
4.2	Type	Multicore, PE insulated, overall screened instrument cable.	

E. DATA SHEET FOR ELECTRICAL MOTORS			
Item	Description	Designer	Tender
1.	Typical motor datasheets		
1.1	Manufacturer	Vendor to Specify	
1.2	Class of Insulation	H	
1.3	Type of Winding Over-Temperature Protection Device	N/A	
1.4	Type of Motor	3-phase induction motor - squirrel cage rotor	
1.5	Rated Output Power	110kW	
1.6	Rated Full-Load Current:		
1.6.1	Current at Duty Point Phase 1	170A	

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1.6.2	Current at Duty Point Phase 2	170A	
1.6.3	Locked rotor current	336A	
1.7	Nominal Voltage	400V	
1.8	Frequency	50Hz	
1.9	Poles	4	
1.10	Full-load Speed	Vendor to specify	
1.11	Slip	Vendor to specify	
1.12	Rated Torque:		
1.12.1	Full-load Torque	193Nm	
1.12.2	Locked rotor torque	Vendor to specify	
1.12.3	Breakdown torque	Vendor to specify	
1.13	Insulation class	H	
1.14	Temperature rise	80K	
1.15	Locked rotor time	Vendor to specify	
1.16	Service factor	Vendor to specify	
1.17	Duty cycle	S1	
1.18	Ambient temperature	Vendor to specify	
1.19	Altitude	1000m	
1.20	Degree of protection	IP66	
1.24	Noise level	63dB(A)	
1.25	Frame	200L	
1.26	Power Factor:		
1.26.1	Power Factor at Full-Load	Vendor to specify	
1.26.2	Power Factor at 3/4 Load	Vendor to specify	
1.26.3	Power Factor at 1/2 Load	Vendor to specify	
1.27	Efficiency:		
1.27.1	Efficiency class	Top premium efficiency - IE3	
1.27.2	Efficiency at Full-load	Vendor to specify	
1.27.3	Efficiency at 3/4 load	Vendor to specify	
1.27.4	Efficiency at 1/2 load	Vendor to specify	
1.28	Approximate weight	Vendor to specify	

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1.29	Moment of inertia	Vendor to specify	
1.30	Additional Information		

PSLE 2 DESIGN BUILT BY NOMINATED SUBCONTRACTOR BULK ELECTRICAL

PSEL 2 – ELECTRICAL SUPPLY AND DISTRIBUTION WORKS

PSEL 2.1 GENERAL

The Works shall include the design, procurement, manufacture, supply, installation, testing, commissioning and handover of all electrical infrastructure required for the operation of the Empuluzi Off-Channel Storage Dam (OCSD), High-Lift Pump Station, Intake Tower, associated control systems and ancillary facilities.

The electrical works shall be undertaken by a nominated specialist electrical subcontractor appointed in accordance with the Contract requirements and shall comply with the requirements of Eskom, SANS standards, Occupational Health and Safety Act, NRS specifications and all applicable statutory regulations.

PSEL 2.2 PERMANENT ELECTRICAL SUPPLY

The nominated electrical subcontractor shall be responsible for the design and construction of a dedicated 22 kV electrical supply line from the Eskom Redhill Substation to the Empuluzi Dam Site.

The Contractor shall liaise with Eskom and all relevant authorities to obtain approvals, wayleaves, servitudes, permits and connection agreements required for the installation and commissioning of the electrical supply infrastructure.

The 22 kV supply system shall be designed to provide a reliable power supply for the operation of the pump station, intake works, dam monitoring systems, control systems, lighting, security systems and all associated plant and equipment.

PSEL 2.3 ESKOM FEEDER BAY

The Works shall include the design, supply, installation, testing and commissioning of a complete 22 kV feeder bay at the Eskom Redhill Substation.

The feeder bay shall include all switchgear, protection equipment, metering, control equipment, communications interfaces, cabling, earthing systems and associated ancillary equipment required by Eskom for connection to the distribution network.

All protection systems shall be fully coordinated with Eskom requirements and shall be subject to Eskom review and approval prior to commissioning.

PSEL 2.4 MAIN TRANSFORMER

The Works shall include the supply, installation, testing and commissioning of a 2 MVA, 22 kV/400 V transformer complete with:

- Transformer plinth and civil works;
- HV and LV switchgear;
- Protection systems;
- Metering systems;
- Earthing and lightning protection systems;
- Control and monitoring equipment;
- Oil containment facilities where required;
- All associated cabling and accessories.

The transformer installation shall be designed to provide the full operational electrical demand of the completed scheme.

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PSEL 2.5 STANDBY POWER GENERATION

The Works shall include the supply, installation, testing and commissioning of a standby diesel generator rated at 2 MVA or equivalent approved capacity.

The standby generator shall be capable of maintaining essential operations during interruptions to the Eskom power supply and shall operate automatically through an approved automatic mains failure (AMF) and changeover system.

The standby power installation shall include all necessary fuel storage facilities, control systems, acoustic attenuation measures, exhaust systems, bunding, ventilation systems and associated infrastructure.

PSEL 2.6 TEMPORARY CONSTRUCTION POWER SUPPLY

The Contractor shall provide a temporary electrical supply for construction purposes comprising a minimum 100 kVA, 22 kV/400 V supply arrangement or approved equivalent.

The temporary supply shall be installed, operated and maintained throughout the construction period and shall provide sufficient capacity for construction plant, site offices, laboratories, workshops, lighting, communication systems and other temporary facilities.

The Contractor shall be responsible for all costs associated with temporary electrical supply infrastructure, operation, maintenance and electricity consumption during construction.

PSEL 2.7 TESTING AND COMMISSIONING

Upon completion of the electrical works, the Contractor shall undertake all inspections, testing and commissioning necessary to demonstrate compliance with Eskom requirements, applicable standards and the Contract requirements.

Testing shall include, but not be limited to:

- Transformer testing;
- Protection relay testing;
- Cable testing;
- Earthing system testing;
- Generator load testing;
- Functional testing of control systems;
- Automatic changeover testing;
- SCADA and communication system testing;
- Integrated system commissioning.

The electrical installation shall not be accepted until all tests have been successfully completed and all necessary Eskom approvals and energisation certificates have been obtained.

PSEL 2.8 OPERATION AND MAINTENANCE DOCUMENTATION

The Contractor shall provide complete operation and maintenance manuals, manufacturer's documentation, protection settings reports, test certificates, as-built drawings and training for the Employer's operational personnel prior to Taking Over of the Works.

1 HYDRO MECHANICAL EQUIPMENT

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HYDRO-MECHANICAL EQUIPMENT

Scope and Definitions

This section deals with the design, supply, installation and commissioning of the Hydro-Mechanical parts of the Works.

1.1.1 Scope

- a) The Contract shall include the design, supply of all materials, manufacture, shop assembly and testing, corrosion protection, delivery to site, storage and installation at site, site painting, testing, Tests on Completion and maintenance (other than normal operating maintenance) of the Plant listed below:

Diversion Weir Structure hydromechanical equipment summary:

- 3 No. 10.5m wide x 2.2m high Weir crest TOPS gates
 - 5 No. 15.7m wide x 2.2m high Weir crest TOPS gates
 - 3 No. 10.4m wide x 6.5m high curved stoplogs for scour gates
 - 3 No. scour gates with 8m wide x 3.5m clear opening
 - 3 No. 8.5m high 20 ton safe load gantry frames, beams and 2 x 10 ton tackle type chain hoists.
 - 2 x 1300NB diaphragm valves for EWR and smaller releases.
 - All gates to be automatic to open and close in response to the upstream pond water levels.
- b) The Plant shall be supplied with all necessary items to provide complete working installations including all built-in parts and anchors, rail tracks, covers and frames.
- c) All civil engineering work in forming and preparing box outs, chases etc., to receive the built-in parts and in placing concrete around them or grouting-in base plates and holding down bolts and the like shall be carried out by the Civil Contractor.

The tender drawings outline the general requirements of the gates and screens. The Civil Contractor shall develop the detailed tender design in each case, within the space and layout constraints indicated by the tender drawings and in accordance with the overall requirements of the specification.

- d) The Civil Contractor shall be deemed to have taken into account, inter alia, all of the operating and maintenance requirements and physical conditions in preparing his Tender in addition to the operating and climatic conditions prevailing at the Site.

- e) The Civil Contractor shall be responsible for all operations necessary for the adjustment and testing of the hydro-mechanical equipment until it has been taken over. During the entire testing (and pre-testing) period, the Civil Contractor shall be wholly responsible for the preservation, care and remedying of any defective parts of the hydro-mechanical equipment. The Civil Contractor shall provide all labour, supervision, guarding, apparatus, materials, stores, instruments etc., necessary for the effective discharge of these obligations.
- f) The Civil Contractor shall permit and facilitate the Employer's observation of the fabrication, erection, installation and testing of all hydro-mechanical equipment. The Civil Contractor shall ensure that specialist personnel from sub-contractors are on hand over the entire planned duration of the tests and have made contingency plans to remain present in the event that the tests over-run their expected duration.

1.1.2 Definitions

For the purpose of this document:

- (a) **“design”** includes, as applicable, the submission of design documentation for approval by the Employer.
- (b) **“supply”** includes, as applicable, the purchase of materials or goods, manufacture and fabrication, any specified corrosion protection measures and any off-site inspection or testing.
- (c) **“installation”** includes, as applicable, all handling and transport from storage, if necessary, all erection and setting to work.
- (d) **“Tests on Completion”** includes, as applicable, the ‘dry’ and ‘wet’ “commissioning” tests as specified.
- (e) **“RL”** means reduced level in meters.
- (f) **“FPL”** means full pond level.

1.1 Diversion works and weir

1.1.1 TOPS Gates

Eight spillway crest TOPS gates are fitted to the right bank spillway in two sizes, 3 x 10.5m wide x 2.2m high and 5 x 15.7m wide x 2.2m high. The TOPS gates are designed to automatically control the RDD flood water level after the opening of the main spillway scour gates to maintain the upstream water level of 1312 masl to ensure that water is diverted to the off-channel dam.

The TOPS gate can be operated manually to decant flotsam or release water from the reservoir ahead of floods.

All the gates are assumed to be open during the SED flood damming calculation. The gates are mounted to axle units mounted on reinforced concrete piers cast onto the crest spillway and the total discharge required at the FPL 1312masl is 643.6m³/s. The total discharge capacity of the gates at RL1314.61 masl is 2215.5m³/s.

The particular requirements for the gates are as follows.

- a) The TOPS gates will automatically open to maintain the FPL of the diversion weir at 1312masl after the scour gates in the main spillway have opened. The TOPS gates should remain open as the upstream water level rises to the maximum RL 1314.61masl when the emergency spillway will discharge excess water.
- b) The requirements of **sub-clause 1.2.3** shall apply to the provision of the gate and its associated components.
- c) It is to be confirmed, to the satisfaction of the Employer, that the gate runs freely in its guides before the second stage concrete is cast. This test shall then be repeated post the casting of second stage concrete.
- d) The gate shall be capable of opening under a range of upstream water levels from 1312masl to 1314.61masl. The gates shall be capable of maintaining the FPL at 1312masl with all 3 orifice scour gates open.
- e) The gate shall be designed for a maximum upstream water level of 1314.61masl with an additional 10% over-pressure allowance for pressure transients due to closure under full flow. The gate shall be able to withstand, as an overloading condition, the combined forces of the design static head and a seismic acceleration of 0.107 g. The effects of increased pressure head shall be considered in the seismic computations.
- f) The weight of the gate shall be such that it seats on the sill with sufficient force to supply seating pressure for the sill seal.
- g) The gate shall be manufactured from SJ355W Mild steel except as provided for below and painted according to the **sub-clause 1.2.3.4** Painting and Corrosion Protection.
- h) The trunnion bushes to the axle shaft shall be a low friction self-lubricating type such as vesconite hi-lube material.
- i) The sealing and sliding surfaces shall be in Grade 316L stainless steel.
- j) A lifting lug shall be provided to lift the gate directly with a crane. This lifting lug shall be manufactured from 304 stainless steel or better.
- k) Sealing shall be as specified in **sub-clause 1.2.3.2**. The seals shall be protected from being damaged by any solid matter larger than 10 mm which might be suspended in the water.
- l) During installation proper care shall be taken to facilitate alignment and matching of corresponding surfaces as well as drop tight sealing of the gate against its sealing frame.

1.1.2 Stoplogs for Scour Gate

Three stoplogs shall be used to close off the entrances to the scour tunnels ahead of the scour gate closure plates for maintenance purposes. The scour gate body is housed in a buoyancy chamber and certain components can be inspected without closing the stoplog. The stoplogs will be installed, removed and operated using a portal gantry

frame with tackle type hoists from the access platform and pier above.

The particular requirements for each stoplog are as follows.

- a) Each stoplog shall be provided to seal off a clear opening of 10.4 m wide x 6.5 m high, at the upstream end of the scour tunnel, as indicated on the drawings.
- b) Provision of the stoplog is to include all associated components such as the SS gate guides and sealing frames.
- c) The requirements of **sub-clause 1.2.3** shall apply to the provision of the stoplog gate and its associated components.
- d) The stoplog shall run freely in its guides before and after the second stage concrete is cast.
- e) The stoplog shall normally be removed under balanced conditions and be able to be installed under full discharge conditions.
- f) The stoplog shall be designed for a maximum static head of 20.7 m.
- g) The rubber seals shall be protected from being damaged by any solid matter larger than 10 mm which might be suspended in the water. The material used shall be as per **sub-clause 1.2.3.2**.
- h) During installation proper care shall be taken to facilitate alignment and matching of corresponding surfaces as well as drop tight sealing of the gate against its sealing frame.
- i) The stoplog shall be provided with dogging pins to hold it in position at the top of the guides before it is lowered into position. The pins shall be lockable in the fully retracted position. The stoplogs and grappling beam shall be stored in the guides just below the spillway crest.
- j) A lifting lug shall be provided to lift the gate directly with the crane hook.
- k) The gate shall have steel stubs/legs on the upstream side on which the gate may be rested during maintenance of the seals.
- l) A downstream skinplate shall be utilised.
- m) The stoplog shall be manufactured from mild steel and painted according to **sub-clause 1.2.3.4 Painting and Corrosion Protection**.
- n) It shall be possible to raise the stoplogs sufficiently using a gantry frame and hoists positioned on the piers in order to allow a large crane positioned downstream of the spillway to lift stoplogs off the diversion weir when maintenance is required.

1.1.3 Scour Gates

The Empuluzi weir is fitted with 3 automatic scour gates in the right bank portion of the concrete weir at the riverbed level. These gates function as the main spillway with a combined discharge of 1134.3 m³/s to maintain the FPL of 1312masl during the RDD flood. These orifice gates are designed to open once the upstream water level reaches the FPL of 1312.0masl. The discharge capacity of all three gates during the SED flood at 1314.61masl is 1232m³/s. Water will enter an inlet weir at 1312masl and flood the buoyancy chamber, causing the fixed buoyancy tank to float up by 3.5m from the chamber floor, effectively opening the 8m x 3.5 m tunnel outlet below the gate.

The gates must be able to open automatically from 1312masl up to maximum water level of 1314.61masl. Flood waters from upstream will flow at high velocity through the 8 m wide x 3.5 m high scour tunnel outlet and discharge sediment from the area just upstream of the diversion weir. The gates will remain open until the upstream water level drops below the intake weir level upstream at 1312masl.

Figure 1 below shows the scour gates in the closed position and Figure 2 below shows scour gate in the fully open position.

The gates should close automatically under full flow conditions for upstream water level below 1312masl. The gates are also designed to be opened manually by valve control for drawdown flushing of sediment during the wet season. A 400NB diaphragm valve will be opened and closed manually for this operation. A dogging device must be provided to keep the gate in an open position when required.

The particular requirements for the gate are as follows.

- a) Three scour gates to be provided to seal off a clear opening of 8 m wide x 3.5 m high, at the downstream end of the scour tunnel, as indicated on the drawings.
- b) As such it is to be operated by a buoyancy tank in a chamber above the scour tunnel and is to be a automatically operating scour gate with a radius of 12.5m from the pivot to the seals. When fully raised the gate is to be clear of the scour tunnel.
- c) The chamber above the scour tunnel is to be 10 m wide x 12.5 m long as shown on the drawings. This chamber shall automatically fill with water when the water level up stream of the weir reaches RL 1312m. It shall also be possible to manually fill the chamber with water by operating a valve when the upstream water level is at or above the FSL of RL 1300. Water shall be able to drain from the chamber such that when the inflow is stopped the chamber drains and the gate automatically closes. It shall be possible to manually open and close all inflow and outflow pipes from the access platform above the chamber. The capacity of the chamber inlets and outlets shall be designed such that the gate has an opening and closing speed of approximately 0.5 m per minute. The gate chamber inlets for the automatic operation of the scour gate shall be located inside the scour channel. The inlet for the manual operation of the scour gate shall be in the upstream headwall of the chamber.
- d) The requirements of **sub-clause 1.2.3** shall apply to the provision of the gate and its associated components.
- e) It is to be confirmed, to the satisfaction of the Employer, that the gate runs freely in its guides before and after the second stage concrete is cast.
- f) The gate shall be capable of opening automatically under a range of water depths from 1312masl to 1314.61masl. The gate shall be capable of closing under full flow resulting from an upstream water level of 1312masl or less.
- g) The gate shall be designed for a maximum water level of 22.25 m with an additional 10% over-pressure allowance for pressure transients due to closure under full flow. The gate shall be able to withstand, as an overloading condition, the combined forces of the design static head and a seismic acceleration of 0.107 g. The effects of increased pressure head shall be considered in the seismic computations.
- h) The weight of the gate shall be such that it seats on the sill with sufficient force to supply seating pressure for the sill seal when the chamber above the scour tunnel is completely drained.
- i) The fixed buoyancy tank and pivot arms shall be manufactured from SL355W mild steel and shall be painted according to **sub-clause 1.2.3.4** Painting and Corrosion Protection.
- j) The trunnion bearings shall be self-lubricating and self-aligning.
- k) A dogging device shall be provided to lock the gate in the raised position. The pin shall be lockable in the fully extended and retracted position.

- l) The skin plate of the gate shall be 3CR12 and shall be painted according to **sub-clause 1.2.3.4** Section Painting and Corrosion Protection.
- m) The vertical side closure plates of the gate shall be manufactured from 3CR12 coated if they are closer than 300 mm to the side walls.
- n) The sealing and sliding surfaces shall be in Grade 316L stainless steel.
- o) The guide blocks shall be manufactured from vescolene ultra black blocks and situated downstream of the side seals.
- p) A lifting lug shall be provided to lift the gate directly with a crane. This lifting lug shall be manufactured from 3CR12.
- q) Sealing shall be as specified in **sub-clause 1.2.3.2** The seals shall be protected from being damaged by any solid matter larger than 10 mm which might be suspended in the water.
- r) During installation proper care shall be taken to facilitate alignment and matching of corresponding surfaces as well as drop tight sealing of the gate against its sealing frame.

1.1.4 Gantries and manual hoists

The stoplogs ahead of the scour gates can be raised and lowered using manual tackle type hoists mounted to the steel beam with trolleys mounted on the beam supported by gantry frames mounted on the concrete piers. Two 10 ton manual tackle type hoists can be maneuvered from an access spanning across the piers used to mount the TOPS gates.

The particular requirements for each gantry and hoists are as follows.

- a) The safe lifting loads for the gantries and hoists are as follows:
 - a. 10 ton safe load travelling gantry and hoists: Curved steel stoplogs ahead of scour gates.
- b) Provision of the gantry and hoists is to include all associated components such as the rails, cables, slings and chains.
- c) The requirements of **sub-clause 1.2.3** shall apply to the provision of the travelling gantries and manual hoists and its associated components.
- d) Gantries and hoists must be maintained and stored safely in order to improve reliability.

1.1.5 2 x 1300NB diaphragm valves

Two 1300NB diaphragm valves (DV) are fitted into reinforced concrete chambers with security materials to prevent unauthorised access to the valves (concrete work to chambers not included in this quotation) on the downstream side of the dam with one DV connected via control piping to the float control at the measuring weir constructed downstream to provide the required 0.4m³/s for EWR. (weir and adjustable weir plates not included in this estimate). The first DV will control the discharge up to 6.16m³/s, if the water levels upstream continue to rise above the inlet weir intake at FSL +100mm, the second DV will open to increase the discharge to 12.16m³/s. If the upstream water levels continue to rise the scour gates and TOPS gates will open incrementally.

The particular requirements for the 3CR12 diaphragm valves is as follows:

- a) Two SS316 1300NB puddle pipes will be cast into the weir upstream of the diaphragm valve reinforced concrete manholes.
- b) Both diaphragm valves will be connected to upstream SS316 inlet weirs set at the FSL upstream with control piping connected to the diaphragm valves.
- c) One diaphragm valve will be connected to a float control valve in a chamber adjacent to the downstream measuring weir in order to constantly release the EWR requirement of 0.4m/s.
- d) If the upstream water level increases to FSL+50mm, the first diaphragm valve will open to release 6m³/s. If the upstream water level continues to rise, the second diaphragm valve will open as water flows into the inlet weir set at FSL +100mm to release an additional 6m³/s, taking the discharge to 12 m³/s.
- e) If the upstream water level further increases then one of the scour gates will open to release a large discharge.

1.2 General

1.2.1 Built-in Parts

- a) Those parts of the Works (e.g., base plates) which are required to be built into the concrete structure with precision are referred to herein as "second stage built-in parts".
- b) In order that the second stage built-in parts may be rigidly supported during the building in, they shall be attached by means of adjustable bolts and the like to anchors, ties, etc., already incorporated into the structure and these anchors, ties, etc., are referred to herein as "first stage built-in parts".
- c) First stage built-in parts shall be built into the structure by the Contractor in accordance with drawings and information supplied by the manufacturer of the hydro-mechanical equipment and to the approval of the Employer.
- d) The Contractor shall be responsible for ensuring that the parts are built in with sufficient accuracy for their purpose. First stage built-in parts shall have not less than two 6 mm diameter holes (suitably spaced) drilled in them so that the parts may be bolted or nailed to formwork to hold them securely in position during first stage concreting.
- e) The Contractor shall ensure that the first stage built-in parts are delivered to Site timeously and that the Employer receives the necessary drawings and information, by the dates shown on the approved programme.
- f) The Contractor shall be responsible for the design, detailing, manufacture, painting, trial erection, transport, storage and supervision of embedding in first stage concrete of first stage built-in parts. The Contractor shall ensure the correctness of the line and level of such parts before and after the concrete has been placed, all to the satisfaction of the Employer. The Contractor shall nevertheless ensure that first and second stage built-in parts are designed and manufactured in such a way that adjustment is possible between the first stage built-in parts and second stage built-in parts to allow precise setting of the latter.
- g) Special attention shall be given to the provisions made to facilitate erection and alignment. All first stage anchor plates for building into the primary concrete shall be provided. All second stage anchor bolts/bars and adjusting nuts shall be provided for the gate and screen sealing frames and guide sections.

- h) Second stage anchor bolts/bars shall be a minimum of 16 mm diameter and shall be welded to the anchor plates to enable accurate adjustment and alignment of the frame and guide sections to be made. The anchors shall be arranged to ensure that no movement of the members occur during placing of the secondary concrete around them.
- i) All welds on built-in parts, including those between adjusting bolts and first stage anchors, shall be adequate to develop the full strength of the abutting members in order to resist separation of the built-in parts from the surrounding first and second stage concrete and of the adjusting bolts from the first stage anchors.
- j) All first and second stage built-in parts shall be arranged so as to allow the proper placing and compaction of concrete and eliminate any air voids around the embedded parts. They shall be suitably shaped to allow fixing second stage reinforcement generally as shown on the drawings.
- k) All permanently immersed built-in parts in contact with water, or where maintenance painting is not possible, shall be of Grade 316L stainless steel up to a water path of 150 mm. All parts covered in concrete but within 50 mm of the surface shall also be considered to be in contact with water and be treated as above. Nuts, bolts and washers of second stage built-in parts which will be subject to an exterior environment in the completed Works shall be stainless steel.
- l) Nuts, bolts and washers of second stage built-in parts which will be subject to an interior environment in the completed Works shall be hot-dip galvanized. Electro-plated metallic coatings to fasteners shall not be acceptable.
- m) Stainless steel nuts, bolts and washers shall be insulated from mild steel parts using sleeves and washers to the approval of the Employer.
- n) All first stage built-in parts shall be coated with a hold primer to prevent corrosion of the parts until such time that the second stage built-in parts can be erected.

1.2.2 Restriction on Loading of Built-in Parts

Built-in parts shall not have loads applied to them earlier than the latest date of either:-

- a) 7 days after completion of epoxy grouting in or -
- b) 28 days after completion of first stage or second stage concrete, or such earlier date as may be approved by the Employer.

1.2.3 Gates

1.2.3.1 General

- 1.2.3.1.1 Gate bodies and non-detachable parts shall be welded constructions. All welds shall be continuous and allow no crevices to be formed.
- 1.2.3.1.2 The minimum thickness of the skin plate shall be 10 mm. Other gate plates minimum of 8 mm.
- 1.2.3.1.3 The gates shall be designed in such a manner that water retention areas are avoided. All drainage holes shall be a minimum of 50 mm in diameter. The design shall avoid areas and profiles that are difficult to paint. Where this is unavoidable the areas shall be boxed, and seal welded to the satisfaction of the Employer.
- 1.2.3.1.4 Parts that are difficult to reach after installation or that require "frequent" disassembly (as determined by the Employer) shall be manufactured from Grade 316L stainless steel.
- 1.2.3.1.5 No threaded holes into mild steel shall be allowed. Threaded holes shall be avoided where possible and where unavoidable shall be into stainless steel 316L.
- 1.2.3.1.6 All axles or moving parts shall be from Grade 316L stainless steel or other suitable corrosion resistant steel as approved by the Employer. All mating surfaces shall also

- be from stainless steel. Stainless steel inserts into mild steel parts shall be used if necessary to achieve this.
- 1.2.3.1.7 All bushes and guides shall be self-lubricating polymers (i.e. Vesconite or equal) where possible.
- 1.2.3.1.8 Guide blocks fitted to the gates shall be in vescolene ultra black blocks.

1.2.3.2 Seals

- 1.2.3.2.1 The gates shall be provided with adequate seals to ensure that when the gate is in a closed position and isolating any intake leakage past the seals shall not exceed 1l/sec/m of seal after a minimum of 5 years in operation under the specified operating conditions.
- 1.2.3.2.2 The type and size of seals used shall be selected from the standard range of seals as per sketch 1 below.
- 1.2.3.2.3 The seals are to have the following qualities:
- 1.2.3.2.3.1 Material : Ethylene Propylene Diene Modified (EPDM) with a 1.6mm thick PTFE lining extruded on the sealing surface.
- 1.2.3.2.3.2 Specific Gravity : 1.21±0.03
- 1.2.3.2.3.3 Tensile Strength : 9 MPa
- 1.2.3.2.3.4 Elongation at break : 350%
- 1.2.3.2.3.5 Shore hardness : 55 – 60°
- 1.2.3.2.4 Dimensional tolerance of the seals shall comply with ISO 3302, unsupported extrusion class E2
- 1.2.3.2.5 Normal dimensions:
- | | |
|---------------|----------|
| 10 to 16 mm: | ± 1 mm |
| 16 to 40 mm: | ± 1.3 mm |
| 63 to 100 mm: | ± 2 mm |
- 1.2.3.2.6 The lashing strips shall be clearly marked (numbers to be welded on) to indicate their correct position relative to the gate - hole alignment. The bolt holes in the seals shall be drilled in the factory and the seals shall be marked to indicate their correct position - alignment of holes.
- 1.2.3.2.7 The lashing strips shall be manufactured from 304L stainless steel and shall not join at the same points as the seals.
- 1.2.3.2.8 All bolts and fixings for the seals shall be of stainless steel. Countersunk head screws shall be of the Allen type. 1 mm thick Nylon 6E washers shall be used under the countersunk screw heads. Duro washers shall be used under the washers and nuts.
- 1.2.3.2.9 All corner seal sections shall be moulded in one piece.
- 1.2.3.2.10 All seals to be joined using a cold curing rubber epoxy to be approved by the Employer.
- 1.2.3.2.11 All moulds and dies for the seals shall become the property of the Employer.

1.2.3.3 Sealing Frames and Guides

- 1.2.3.3.1 Sealing frames shall consist of upstream and side guides and side-, sill- and lintel sealing members where appropriate.
- 1.2.3.3.2 All sealing-, sliding- and running surfaces shall be of stainless steel, Grade 316L or better. The sealing frames and guides shall also be of stainless steel Grade 316L plates and sections and shall be fabricated so as to give a rigid structure.
- 1.2.3.3.3 The sealing frames shall ensure a minimum water path of 300 mm through the surrounding concrete.
- 1.2.3.3.4 The gate seals shall be in contact with sealing frames during movement of the scour gate in the guides, whilst the TOPS gates have face seals which are only in contact

with the seal plates in the closed position.

- 1.2.3.3.5 All sections shall be perfectly straight, flat and true to the dimensions provided by the Contractor. The straightness tolerance shall be 1 mm in 1 m to prevent unequal pressure or leakage.
- 1.2.3.3.6 All guide members of a specific set shall be bolted together in sequence at the Manufacturer's Works for inspection and, after approval by the Employer, each individual guide member shall be marked by hard stamping with corresponding numbers in order for them to be installed in the same sequence.
- 1.2.3.3.7 All sealing and rolling surfaces shall be smooth, with no steps or misalignment at the joints between different guide sections.
- 1.2.3.3.8 All parts permanently in contact with the water shall be of stainless steel Grade 316L on the exposed side.
- 1.2.3.3.9 Special attention shall be given to the provisions made to facilitate erection and alignment.
- 1.2.3.3.10 All second stage anchor bars and adjusting nuts shall be provided for the gate and screen sealing frames and guide sections.
- 1.2.3.3.11 These bars shall be a minimum of 16 mm diameter and shall be welded to the anchor plates to enable accurate adjustment and alignment of the frame and guide sections to be made.
- 1.2.3.3.12 The anchors shall be arranged to ensure that no movement of the members occurs during the placing of the secondary concrete around them.
- 1.2.3.3.13 A clearance of 5 ± 1 mm shall be allowed, in the direction of flow, between the inner surfaces of each guide member and the gate / fine screen element running in it. Across the direction of flow, this lateral clearance shall be minimum 6 mm and maximum 10 mm.
- 1.2.3.3.14 The guides shall be designed to minimize cavitation.

1.2.3.4 Painting and Corrosion protection

REFER TO SCHEDULE 27.

1.3 Tests on Completion

The Tests on Completion of mechanical plant shall consist of:

- a) Assembly and testing of the gate travel and seal frame contact at the fabrication works prior to dispatch to site. The seal frame is then bolted to the gate in order to ensure proper alignment and to protect the slender seal frames from transport damage.
- b) First stage, or dry testing, which the Contractor shall commence without undue delay upon completion of erection.
- c) Second stage, or wet testing, which shall take place as soon as practical after the completion of the entire Works.

1.3.1 First Stage (Dry) Testing

1.3.1.1 General

All Plant and equipment shall be carefully inspected and tested at the Site after erection to show that it is satisfactory. These tests shall be carried out in the presence of and

to the satisfaction of the Employer, who shall, at least 5 working days prior to the testing, have been provided with the most recently approved draft of:

- 1.3.1.1.1 the appropriate Operation and Maintenance Manual;
- 1.3.1.1.2 the approved proposed dry testing procedure, prepared in appropriate detail.

1.3.1.2 Stoplogs

- 1.3.1.2.1 Dry testing of the stoplogs (in liaison with the Employer, Contractor and appropriate other subcontractors where interfaces exist) shall include, but not necessarily be limited to tests that demonstrate:
 - 1.3.1.2.1.1 The seals are operating satisfactorily and according to the pre-compression recommended by the gate designer, the clearances in the guides are adequate, and that the gates work correctly under all specified conditions that may be simulated in the absence of water head;
 - 1.3.1.2.1.2 The stoplog operating hoist is able to perform the specified positioning of the stoplogs;
 - 1.3.1.2.1.3 The stoplog dogging arrangements are satisfactory; and
 - 1.3.1.2.1.4 The stoplog may be raised sufficiently above the associated floor to allow loading on a standard heavy goods vehicle.
- 1.3.1.2.2 All instruments and appliances necessary for the complete testing including the supply of electricity shall be provided by the Contractor.

1.3.1.3 TOPS Gate and Scour Gate

- 1.3.1.3.1 Dry testing of the TOPS gate and scour gate (in liaison with the Employer, Contractor and appropriate other subcontractors where interfaces exist) shall include, but not necessarily be limited to tests that demonstrate:
 - 1.3.1.3.1.1 The seals are operating satisfactorily and according to the pre-compression recommended by the gate designer, the clearances in the guides are adequate, and that the gates work correctly under all specified conditions that may be simulated in the absence of water head;
- 1.3.1.3.2 All instruments and appliances necessary for the complete testing shall be provided by the Contractor.

1.3.1.4 Gantries and manual type hoists

- 1.3.1.4.1 Dry testing of the gantry frames and manual tackle type hoists (in liaison with the Employer, Contractor and appropriate other subcontractors where interfaces exist) shall include, but not necessarily be limited to tests that demonstrate:
 - 1.3.1.4.1.1 The gantry frames, beams and tackle hoist trolleys and tackle type hoists must be tested at the safe load for the raising and lowering the curved stoplogs.

1.3.2 Second Stage (Wet) Testing

Second stage testing of the gates shall be carried out after the successful completion of first stage (dry) testing and as soon as practicable after the completion of the whole of the Works and the filling up of the weir and waterways.

Wet testing (in liaison with the Employer, Contractor and appropriate other subcontractors where interfaces exist), of the gates shall include (but not necessarily be limited to) the following:

1.3.5.2

TABLE 1: MAIN HYDRO-MECHANICAL ITEMS

Description	Number	Opening Size	Design Head	Operation
Spillway: TOPS gates	5	15.7m wide by 2.2m high	2.2m	Emergency spillway gates
Spillway: TOPS gates	3	10.5 m wide by 2.2m high	2.2m	Emergency spillway gates
Primary spillway: Stoplogs for scour gate	3	10.4m wide by 6.5m high	20m	Isolation of scour gate, operated with portal crane
Primary spillway: Scour gates	3	8m wide by 3.5m high	22.25m	Scouring the Intake channel, automatic operation with buoyancy tank
20 ton Gantry frame and beams	3	8m high frame with 600mm deep beam and 2 x 10ton hoists	Remove under balanced conditions.	Manual tackle type hoists mounted on trolley and crawler beam
1300NB diaphragm valves	2	1300NB	22m	Inlet weir at FSL to automatically open valves

FIGURE 3: UPSTREAM ELEVATION SCOUR GATES

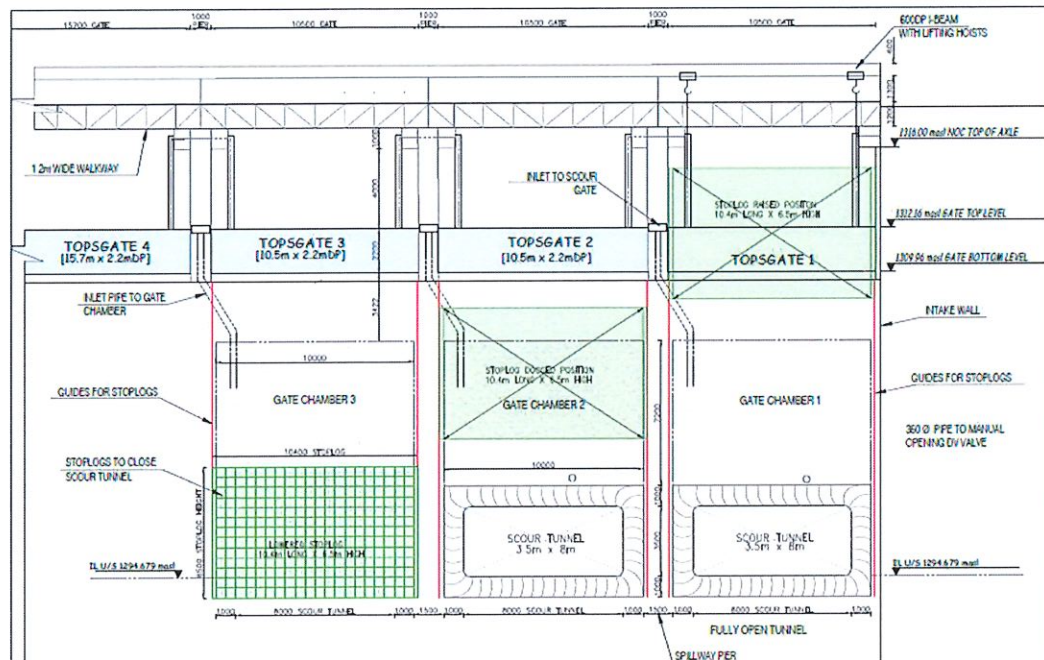
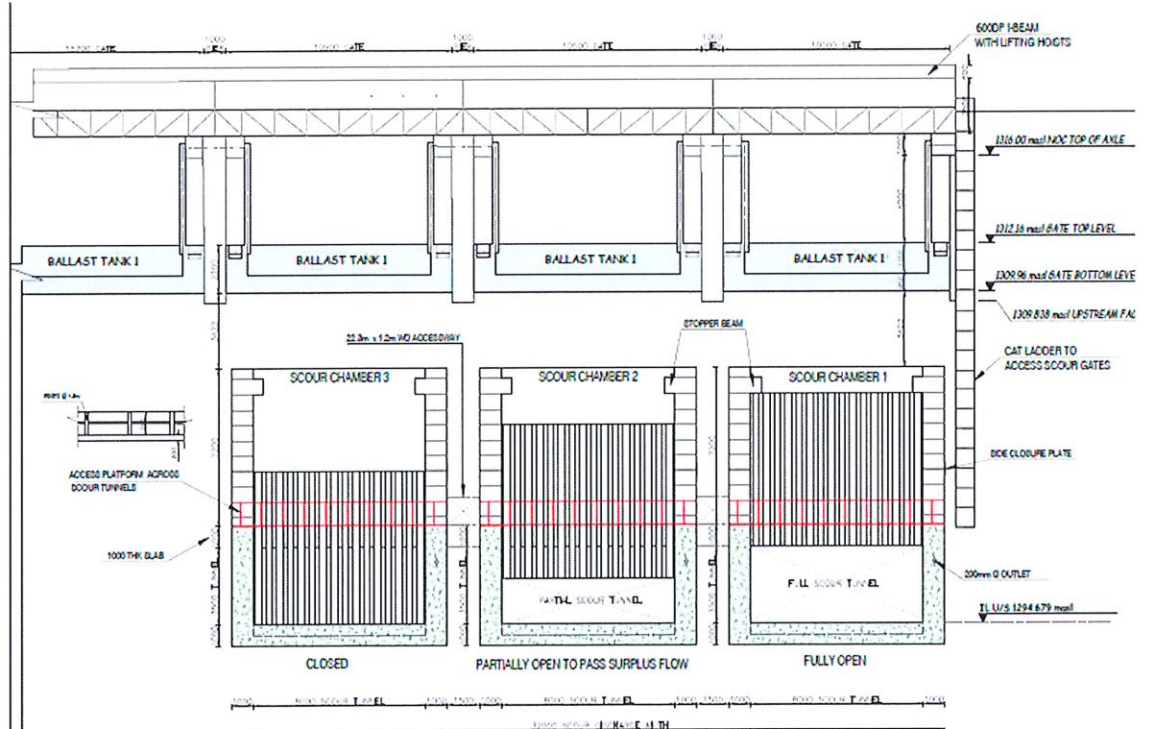


FIGURE 4: DOWNSTREAM ELEVATION



1.3.5.7

FIGURE 5: WEIR ELEVATION WITH ALL GATES

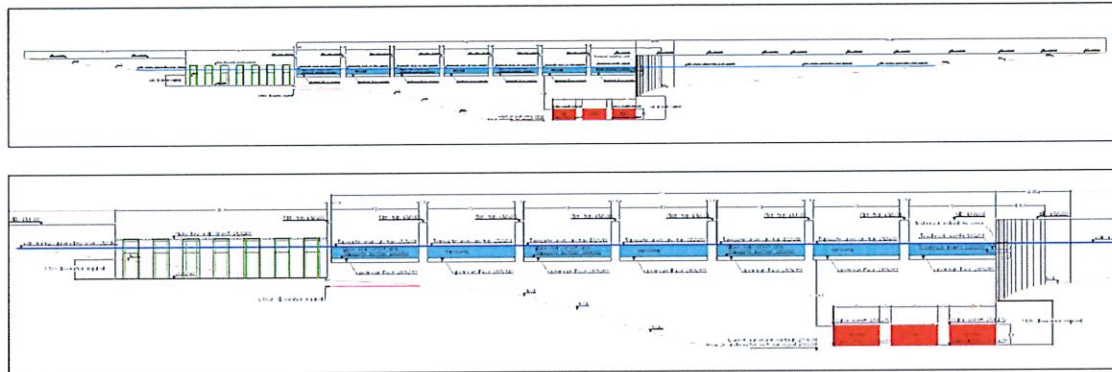
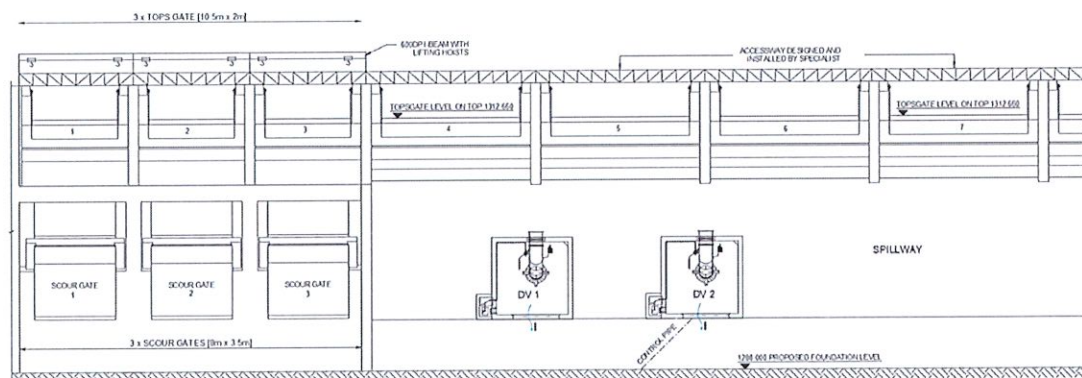


Figure 5-3: Elevation view of the weir and diversion works as viewed from upstream: total weir (top) and enlarged spillway section (bottom)

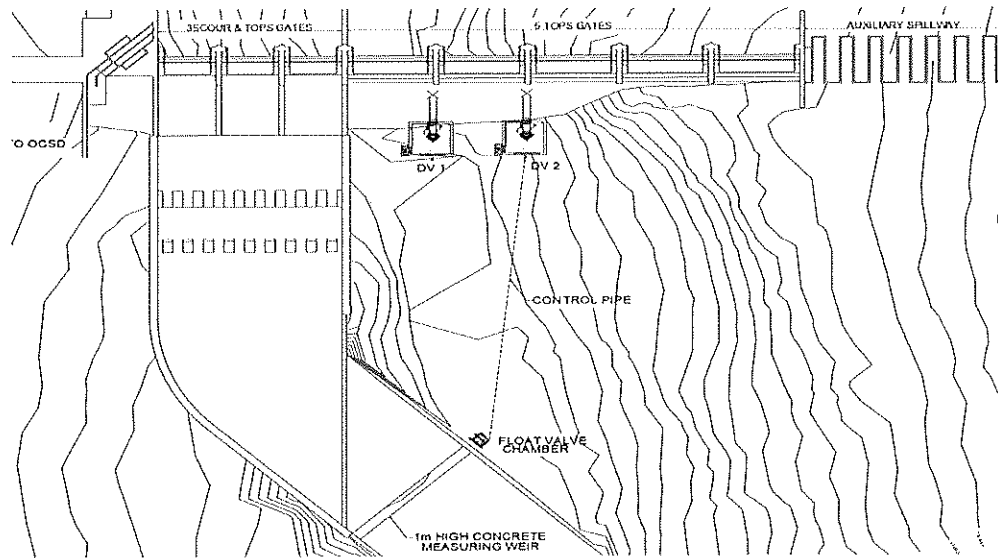
1.3.5.8

FIGURE 6: DOWNSTREAM ELEVATION DIAPHRAGM VALVES



1.3.5.9

FIGURE 7: PLAN VIEW WITH DIAPHRAGM VALVES



1 HYDRO MECHANICAL EQUIPMENT

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HYDRO-MECHANICAL EQUIPMENT INSTALLATION

1. The list of hydromechanical equipment as per above.

2. **Resources to be provided by Main Contractor:**

2.1 Personnel and labour: 8 month period / or as per main contractor's schedule.

- **Office administrator:** Full time employee to run HEM subcontractor offices and boardroom with access to electrical supply, printer, computers, wifi, desks, tables and small kitchen.
- **Office cleaner:** full time employee to maintain HEM subcontractor offices
- **Security personnel:** 2 full time security guards to man the gate to the security fenced laydown area and HEM offices.
- **Site Engineer/coordinator:** full time to coordinate HEM installation with main contractor.
- **Scaffolding erector and inspector:** full time to maintain and erect and dismantle scaffolding in order to ensure the installation team can safely install equipment.
- **Health and safety representative:** Part time coordinator to ensure works are safe and SHEQ requirements are met.
- **General labour:** 6 full time employees to assist with offloading/loading of equipment in the laydown area and on site during installation.
- **Supervisor:** 1 full time supervisor to manage workers and coordinate with HEM subcontractor supervisors and personnel.
- **Survey team:** on request over 8 month period to check alignment and setting out of equipment prior to casting second stage concrete and during dry testing.

2.2 Plant, facilities and equipment resources: 8 month period / or as per main contractor's schedule.

- **150 ton all terrain mobile crane:** Available full time 6 months: Capable of lifting maximum 8 ton sections onto works with 30 m radius. Capable of lifting assembled gates with 50 ton crane during dry testing: 35 tons at 15m reach. With sufficient compliant slings and chain slings and an operator.
- **50 ton all terrain mobile crane:** Available on request over period 8 months. Capable of lifting 8 tons at 15m radius. With sufficient compliant chain and rope slings with an operator. To assist 150 ton crane during dry testing of gates.
- **10 ton crane truck:** Full time to offload arriving equipment and to haul to site for installation. With sufficient compliant slings and chain slings for the works with operator.
- **10 x 20" (6.06m x 2.44m) shipping containers:** 8 months or more installed in laydown area for use to store tools, equipment, spares, small parts, rigging equipment, nuts and bolts, fasteners etc. Containers must be lockable.
- **100mx50m laydown area:** 5000m2 adjacent to the works next to yard with compacted all weather roads within the laydown area with suitable drainage channels and storm water network to allow full access during the wet season. Security lighting and security fence around perimeter with gates at entrance and guardhouse for 24-hour security.
- **3x (6m x 2.44m) office units:** These office units should serviced and furnished offices which are electrified, supplied with wifi, air conditioning for the HEM subcontractor's use. The offices will be allocated to 1 x HEM subcontractor management, 2 x for installation teams, 1 x boardroom for briefings and coordination meetings with main contractor, 1 x health and safety office with first aid station and admin office and 1 office for visiting contractors ie fabricator and service providers and a tea room with kitchenette. Ablutions for 15 persons inside laydown area.

- Scaffolding and walkways: Sufficient suitable scaffold, walkways and support work to allow safe access to the spillway and permanent intake structure to allow installation teams access to the equipment for installation including walkways with kickplates etc.
- Access roads and ramps: suitable access roads for cranes upstream and downstream of structures for delivery of equipment in all weather conditions.
- Messing and accommodation: Provide 3 meals per day for HEM subcontractor and suitable accommodation for 2 x HEM management, 3 x HEM supervisors, 3 x welders, 3 x boilermakers and visiting contractors 4 persons. Total 15.
- Local transport and fuel: 2 x 4x4 double cab vehicles with canopies on back for local transport from accommodation to site, for site use and general use on weekends to shops and local leisure ie to local game reserves and to and from airport in Blantyre as required.
- Workshop facilities: access to metal work and general workshop access for incidental repairs to equipment, tools, vehicles etc.
- Inductions, medical and other training requirements in terms of the H&S management plan of the main contractor: HEM subcontractor's personnel and visiting suppliers/contractors must be inducted, trained and have medical entry and exit examinations as per the HSMP of the main contractor in order to gain access to site and work safely. Updated as required over a 8 month period.

2.3 MC BOQ installation: attached

**AMANZIFLOW PROJECTS
SPECIFICATION**

**SECTION 27
PAINTING AND CORROSION PROTECTION**

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SECTION 27

PAINTING AND CORROSION PROTECTION

27.1 SCOPE

This Specification covers the corrosion protection of all steelwork exposed to environments with variable corrosive tendencies.

Plant and equipment shall be manufactured and corrosion protected in accordance with the requirements specified in this Specification. No deviation from the Specification will be allowed without the written approval of the Engineer. In the case of there being conflict between Specifications, this Specification will take preference.

27.2 DEFINITIONS

In this document the word or words:-

- (a) **"Coating"** shall refer to the application of a uniform protective layer of material in the specified manner to the outside of equipment or piping.
- (b) **"Lining"** shall refer to the application of a uniform protective layer of material in the specified manner to the inside of equipment or piping.
- (c) **"Dis-bonded area"** shall refer to an area of coating that initially did adhere to the steel substrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.
- (d) **"Un-bonded area"** shall refer to an area of coating which at no stage adhered to the steel substrate.
- (e) **"Water path"** shall refer to the distance along the surface of a material embedded in concrete but exposed to water measured from the concrete surface.
- (f) **"Dry"** shall refer to atmospheric conditions only and includes periodic wetting by spray or rain.
- (g) **"Wet"** shall refer to permanently or usually "submerged", "submersed" or "immersed" conditions and shall include dry but normally very humid conditions.
- (h) **"Wet/dry"** shall refer to conditions that are intermittently dry and wet as defined above.

27.3 GENERAL REQUIREMENTS

27.3.1 Quality Assurance and Procedures

- a) Quality procedures as specified in Section 20 - General Mechanical shall be adhered to.
- b) The production and application shall be in accordance with SANS 9000, Quality System.
- c) The Contractor shall ensure that he is fully conversant with the requirements of this Specification and the relevant coating systems.

27.3.2 Quality Plan

A detailed quality plan shall be submitted for approval and completion by the Engineer before

manufacture/coating is initiated – refer to Section 20 – General Mechanical.

The Engineer reserves the right to approve the specific paint used before coating is initiated.

27.3.3 Qualified Staff

27.3.3.1 Application

A high standard of workmanship is required. Only experienced personnel shall be used to carry out corrosion protection work.

All work shall be carried out under the constant supervision of a qualified supervisor.

27.3.3.2 Repair Work at Site

All repair work shall be done by competent personnel of the approved applicator under the supervision of a qualified supervisor.

27.4 COMPATIBILITY OF MATERIALS

The Contractor shall ensure that metals or alloys are compatible or are adequately protected if, in the galvanic series, there is more than 0.3 volt difference in the galvanic potential.

27.5 EQUIPMENT

27.5.1 Measuring Equipment

- a) The Contractor shall have the following measuring equipment at his paint shop or site at all times:
 - Ambient temperature gauge;
 - Blast profile gauge;
 - Dew point instrument;
 - Dry film thickness gauge;
 - Electric insulation defect detector;
 - Surface temperature gauge;
 - Relative humidity instrument; and
 - Wet film comb.
- b) All test equipment shall have current calibration certification.
- c) All instruments shall be calibrated daily, except where otherwise specified by manufacturers, to achieve the required accuracy.
- d) Dry film thickness gauges shall be calibrated on a flat surface, provided that the surface profile is in accordance with the Specification.

27.5.2 Spray Equipment

- a) Spray equipment shall be suitable for the production of high quality work, capable of properly atomising the coating material and equipped with suitable pressure regulators and gauges. Air caps, needles and nozzles shall be of the type recommended by the coating manufacturer.
- b) All spray equipment shall be fitted with suitable oil and moisture traps.

27.5.3 Mixer

A low speed mixer, which does not introduce air into the coating material being mixed, shall be utilised.

27.6 INSTALLATION REQUIREMENTS

27.6.1 Anchors In Concrete

- a) All permanent anchors in concrete shall be stainless steel to ASTM A240 grade 316.
- b) Special care shall be taken to ensure that anchors be installed to the correct level and depth. Anchors shall not be cut after installation without prior inspection and approval of the Engineer.
- c) To avoid a galvanic reaction (stainless steel/galvanizing) under wet conditions, the nut and washer shall be FBE coated. Where necessary caps may be specified by the Engineer.

27.6.2 Sealing Of Rails and Guides

Where rails and base plates are installed in high corrosive or humidity areas, edges of the grouting shall be sealed with a continuous Polyurethane sealer approved by the Engineer.

27.7 COATING SYSTEMS

27.7.1 Proprietary Items

Components that are supplied painted or protected e.g. hoists, gearboxes, actuators etc., shall only be accepted provided that they meet the corrosion protection requirements of this Specification. If this Specification cannot be adhered to the Contractor shall submit full details of the equivalent paint systems at Tender stage for approval by the Engineer.

27.7.2 Abbreviations

27.7.2.1 Abbreviations

CI	:	Cast iron - grade 220
CS	:	Cast steel
DFT	:	Dry film thickness
FBE	:	Fusion-bonded Epoxy
FBP	:	Fusion-bonded Polyester
HDG	:	Hot-dip galvanized
PVC	:	Polyvinylchloride
MIO	:	Micaceous Iron Oxide
MS	:	Mild steel – grade 300WA
SG	:	Spheroidal graphite cast iron – grade 420
SS	:	Stainless steel – grades 304, 304L, 316 and 316L
UV	:	Ultra Violet
3Cr12	:	Corrosion resistant steel
µm	:	Micrometer
DCA	:	Die Cast Aluminium

27.7.3 Gates, Screens and Built-in Parts

Selection of all corrosion protection systems shall be submitted to the Engineer for approval before application.

The following tables are abbreviated guidelines and the systems are not listed in order of preference. See notes under SC 27.7.14.

27.7.3.1 Gates

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	3Cr12 and MS	Two Pack Epoxy	400
Dry	3Cr12 and MS	Two Pack Epoxy – plus top coat of: Re-coatable Polyurethane	250 40
Wet	3 SS 304	Pickle and passivate	
Dry	SS 304	Pickle and passivate	

27.7.3.2 Screens

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	SS 316	Pickle and passivate	

27.7.3.3 Grapple

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	3Cr12	Multi-purpose Epoxy	250

27.7.3.4 Steel lining, Guides, Baseplates, Built-In Parts and General Built-In Steelwork

ENVIRONMENT		MATERIAL	SYSTEM	MINIMUM DFT (µm)
WET				
Water path	>150 mm	MS 3Cr12 SS	Un-coated	
	<150 mm	SS	Pickle and passivate	
Concrete cover	>75 mm	MS	Un-coated	
	<75 mm	SS	Pickle and passivate	
		MS	Two Pack Epoxy	250

27.7.3.5 Ropes

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry	MS	Rope dressing - penetrating, water resistant with a non-sticky surface	Refer to SC 27.7.14.1
Dry/Wet	MS	HDG plus penetrating and water resistant rope dressing with a non-sticky surface	85 Refer to SC 27.7.14.1
	SS	Pickle and passivate	

27.7.3.6 Chains

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)

Dry/Wet	MS	HDG	85
	SS	Pickle and passivate	

27.7.3.7 Lashing Strips

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	SS 304 or SS 316	Two Pack Epoxy	125
	3Cr12	Two Pack Epoxy	250

27.7.3.8 Wheels

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Wet	SS 316	Two Pack Epoxy - on sides	125
		Two Pack Epoxy - rolling surfaces	70-90
Dry	SG/CS	Two Pack Epoxy - on sides	300
		Two Pack Epoxy - rolling surfaces	90-125

27.7.4 Hydraulic Equipment**27.7.4.1 Hydraulic Cylinders**

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Dry	MS	Coating	Two Pack Epoxy plus top coat of re-coatable Polyurethane – where specified	250 40
			Two Pack Epoxy	125

27.7.4.2 Pipes

ENVIRONMENT	MATERIAL	SYSTEM
Dry/Wet	SS 316	Pickle and passivate (avoid MS contact and contamination)

27.7.4.3 Fluid Reservoirs

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Dry	MS	Lining	Two Pack Epoxy	200
		Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	250 40
Wet	3Cr12	Lining	Two Pack Epoxy	150
		Coating	Two Pack Epoxy plus top coat of Re-coatable Aliphatic Polyurethane	250 25
	SS 304	Coating	Pickle and passivate	

27.7.4.4 Cabinets

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry	MS	FBE	100

27.7.5 Pumps / Turbines**27.7.5.1 Pumps / Turbines**

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Wet	SG CI	Lining and Coating	Two Pack Epoxy plus top coat of Re-coatable Aliphatic Polyurethane – where specified	400 25
Dry	SG CI	Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	250 40
Wet	SG	Machined close tolerance	Long life Molybdenum Disulphide lubricant	10-15
Abrasive conditions	SG CS	Lining	Abrasion resistant coating – to be approved by Engineer	
Submerged	SG	Coating	Two Pack Epoxy	400

27.7.5.2 Motors / Generators

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Dry	MS	Lining	Two Pack Epoxy	250
		Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	250 40
	SG CI	Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	125 40
	DCA	Coating	Two Pack Epoxy plus top coat of Re- coatable Polyurethane	75 40
Wet	SG CI	Coating	Two Pack Epoxy plus top coat of Re-coatable Aliphatic Polyurethane – where specified	400 25

27.7.6 Valves**27.7.6.1 Valves and Flowmeters, including Handwheels**

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
	MS SG	Lining	Two Pack Epoxy	400
	SS 316	Lining	Two Pack Epoxy Pickle and passivate – See SC 27.7.14.1	150
Dry	MS SG	Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	250 40
Wet	MS SG	Coating	Two Pack Epoxy plus top coat of Re-coatable Aliphatic Polyurethane – where specified	400 25
	SS 316	Coating	Two Pack Epoxy plus top coat of Re- coatable Aliphatic Polyurethane – where specified Pickle and passivate	150 25

27.7.6.2 Gearboxes

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	CI SG	Lining	Two Pack Epoxy	150
		Coating	Two Pack Epoxy plus top coat of Re-coatable Polyurethane	400 40

27.7.6.3 Actuators

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Dry/Wet	SG CI	Coating	Two Pack Epoxy plus top coat of re- coatable Polyurethane – where specified	250 40
	DCA	Coating	Two Pack Epoxy plus top coat of Re- coatable Polyurethane – where specified	200 40
	SG/CI gearbox	Lining	Two Pack Epoxy	125

27.7.7 Pipes and Specials**27.7.7.1 Above Ground**

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Above ground	MS	Lining	Two Pack Epoxy	400
For wet conditions see SC 27.7.7.5		Coating	Multi-purpose Epoxy plus top coat of Re-coatable Polyurethane	250 40

27.7.7.2 Encased In Concrete

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Encased in concrete	3Cr12	Lining	Two Pack Epoxy	400
	3Cr12	Coating	Two Pack Epoxy	400
	SS 304 or SS 316	Lining	Two Pack Epoxy	250
		Coating	Pickle and passivate	
Buried in soil - chamber to coupling	All materials	Coating	Petrolatum wrapping system	

27.7.7.3 Buried In Soil

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Buried in soil	MS	Lining	Two Pack Epoxy	400
		Coating	Bitumen fiberglass wrapping	5.5 mm

27.7.7.4 In Chamber Walls

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
In chamber walls – see note below.	3Cr12 or MS	Lining	Two Pack Epoxy	400
		Coating	Two Pack Epoxy plus top coat of Re-coatable Aliphatic Polyurethane where required plus sealant of Polyurethane or Polysulphide - See SC 27.7.14.1.	400 25
	SS 304	Lining Coating	Two Pack Epoxy	250
Buried in soil – chamber to coupling	All materials		Petrolatum wrapping system	

Note: Where chamber is built around a previously coated pipeline then the intact coating may be retained inside the walls.

All pipes smaller than 250 mm nominal diameter shall only be pickled and passivated.

27.7.7.5 In Water

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
In water and severe corrosion conditions	3Cr12	Lining	Two Pack Epoxy	400
		Coating	Two Pack Epoxy plus Re-coatable Aliphatic Polyurethane	400 25
	SS 304 or SS 316	Lining	Two Pack Epoxy	250
		Coating	Two Pack Epoxy	250

27.7.7.6 Sleeve Valve Hoods

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Wet/Dry	3Cr12	Lining	Two Pack Epoxy	400
		Coating	Two Pack Epoxy plus Re-coatable Aliphatic Polyurethane	400 25

27.7.7.7 In Pumpstation

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
In ambient conditions of the pumpstation	Mild Steel	Lining	Two Pack Epoxy	400
		Coating	Two Pack Epoxy plus pure Aliphatic Polyurethane	400 25
	3Cr12	Lining	Two Pack Epoxy	300
		Coating	Two Pack Epoxy plus pure Aliphatic Polyurethane	400 25
	SS 304	Coating	Aliphatic Polyurethane	25

ENVIRONMENT	MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
Pump Station Puddle Pipes	Mild Steel	Lining	Standard Hall Longmore solvent free epoxy lining (Refer to Section 37 of the Specification)	400
		Coating	Two component solvent free polyurethane (Sigmaline 855 or similar approved. Sigmaline 855 repair or similar approved shall be used as a repair kit) Refer to Section 37. Plus pure Aliphatic Polyurethane for the portion of pipe internal to the pump station (To adhere to Annexure 27-2)	1500 25

27.7.8 Couplings and Dismantling Joints

MATERIAL	SURFACE	SYSTEM	MINIMUM DFT (µm)
MS	Lining and Coating	Two Pack Epoxy	400
SS 304	Lining and coating	Pickle and passivate	
SS 304 buried	Lining and coating	Two Pack Epoxy	150

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Plain Ended Pipes where couplings or dismantling joints are to be fitted	MS/3Cr12	Same as lining material for 300 mm from end	400
		Two Pack Epoxy for cement mortar lining with 100 mm overlap inside and outside	400
Flanges of Bitumen wrapped pipes	MS/3Cr12	Same as lining material on top and back of flange with an overlap of 100 mm from the flange	400
		Two Pack Epoxy for cement mortar lining with 100 mm overlap inside and outside	400
Flange faces and bolt holes	MS/3Cr12	Two Pack Epoxy	60 - 90
Coupling or Flanged Joints Buried in Soil or in Wet Chambers	MS/3Cr12 SS 304 SS 316	Coating system plus Petrolatum wrapping system	
Welded Joints Buried in Soil and encased in concrete	MS/3Cr12 SS 304 SS 316	As specified for lining and coating	

27.7.9 Cranes and Hoists**27.7.9.1 Crane Structures**

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor and outdoor	3Cr12	Multi-Purpose Epoxy	250
Indoor	MS	Multi-Purpose Epoxy	250

27.7.9.2 Crane Structures Fixed To Concrete

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor and outdoor	3Cr12	Multi-purpose Epoxy plus grout under base plus Polyurethane sealant	250
Indoor	MS	Multi-purpose Epoxy plus grout under base plus Polyurethane sealant	250

27.7.9.3 Crawl Beams

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor - Dry	3Cr12	Multi-purpose Epoxy	250
Indoor - Wet	3Cr12	Multi-purpose Epoxy	250
Outdoor	3Cr12	Multi-purpose Epoxy	250

27.7.9.4 Rails Bolted To Concrete

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor – Dry	MS	Two Pack Epoxy: Sides and bottom Rolling surface	250 60-90
Indoor – Wet	MS	Two Pack Epoxy: Sides and bottom Rolling surface	250 60-90
Outdoor	MS	Multi-purpose Epoxy: Sides and bottom Rolling surface	250 60-90

27.7.10 Stainless Steel Items

SURFACES	COATING	MINIMUM DFT (µm)
Stainless steel components (Dissimilar materials in submerged conditions)	Two Pack Epoxy to a smooth, glossy and uniform finish	125
3Cr12 steel components (All submerged conditions)	Two Pack Epoxy	400 250
Stainless steel components (Dry or compatible metal conditions)	Pickle and passivate	
3Cr12 steel components (Dry conditions only)	Pickle and passivate	

27.7.11 Electrical Equipment**27.7.11.1 Electrical Panels and Enclosures**

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	3Cr12 SS 304	FBE	100
	DCA	FBE	75
	PC ABS	Un-coated	
	GRP	Polyester gelcoat	250
Outdoor	3Cr12 SS 304	FBE	125

27.7.11.2 Transformers

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor and Outdoor	MS	Multi-purpose Epoxy	300

27.7.11.3 Diesel Generator

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor and outdoor	MS	Multi-purpose Epoxy	300
	3Cr12	Multi-purpose Epoxy	150
	SS 304	Multi-purpose Epoxy	150
Items subjected to high Temperatures		See SC 27.7.14.1	

27.7.11.4 Industrial Switched Socket Outlets and Light Switch Housings

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	PVC	Un-coated	
	DCA	FBE	75
Outdoor	DCA	FBP	75

27.7.11.5 Cable Support Systems

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Dry	MS	HDG	85
	3Cr12	Pickle and passivate	
Wet	3Cr12	FBE	100
	SS 304 SS 316	Pickle and passivate	

27.7.11.6 Industrial Light Fittings

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor – Dry	MS	FBE	50
	DCA	FBE	50
Indoor – Wet	DCA	FBE	75
	GRP	Polyester gelcoat	250
Outdoor	DCA	FBP	75
	GRP	Polyester gelcoat	250

27.7.11.7 Conduit

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor - Dry	MS	HDG	65
	PVC	Un-coated	
Indoor - Wet	SS 304	Pickle and passivate	
	PVC	Un-coated	
Outdoor	MS	HDG	65
	SS 304	Pickle and passivate	
Underground	HDPE	Un-coated	
	PVC		
	SS 304	Pickle and passivate	

27.7.11.8 Junction Boxes

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	DCA	FBE	75
	PVC	Un-coated	
	GRP	Polyester gelcoat	250
Outdoor	DCA	FBP	75

27.7.11.9 Light Poles and Masts

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	GRP	Polyester gelcoat	250
	SS 304	Pickle and passivate	
Outdoor	MS	HDG	105
	GRP	Polyester gelcoat	250
	3Cr12 SS 304	Pickle and passivate	

27.7.11.10 Cable Mounting Straps and Clamps

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	MS	HDG	45
	PVC	Un-coated	
	SS 304	Un-coated	
Outdoor	SS 304	Un-coated	

27.7.12 Platforms, Ladders, Handrails, Flooring, Doorways and Covers**27.7.12.1 Platforms, Walkways and Flooring**

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	3Cr12	Pickle and passivate	
Outdoor	3Cr12	Pickle and passivate	
Wet	SS 304	Pickle and passivate	

27.7.12.2 Ladders

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	3Cr12	Pickle and passivate	
Outdoor	3Cr12	Pickle and passivate	
Wet	SS 304	Pickle and passivate	

27.7.12.3 Handrails and Balustrades

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	3Cr12	Pickle and passivate	
Outdoor	3Cr12	Two Pack Epoxy plus recoatable polyurethane	250
	MS	Heavy duty galvanized	
Wet	SS 304	Pickle and passivate	

27.7.12.4 Doors, Door Frames and Steel Covers

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Indoor	3Cr12	Multi-purpose Epoxy	125-150
Wet	3Cr12	Two Pack Epoxy 2 coats	250
	SS 304	Pickle and passivate	
Outdoor	3Cr12	Multi-purpose Epoxy	125-150

27.7.13 Fasteners and Anchors**27.7.13.1 Fasteners**

ENVIRONMENT	MATERIAL	SYSTEM	MINIMUM DFT (µm)
Fasteners and washers (dry)	MS	HDG – plus threads coated with Molybdenum Disulphide lubricant or wax	45
	SS 304	Threads coated with Molybdenum Disulphide lubricant or Nickel Anti-seize compound	Uniform cover
Fasteners and washers (Wet/Submerged)/ Dissimilar metals	SS 316	Fusion bonded epoxy coated (thread surfaces excluded) - plus threads coated with Molybdenum Disulphide lubricant or Nickel Anti-seize compound	50

27.7.13.2 Anchors

ENVIRONMENT	MATERIAL	SYSTEM	
Anchors in concrete (dry)	SS 316 or SS 304	Threads coated with Molybdenum Disulphide Lubricant or Nickel Anti-seize compound	Uniform cover
Anchors in concrete (wet)	SS 316 or SS 304	Threads coated with Molybdenum Disulphide Lubricant or Nickel Anti-seize compound plus nut and washer FBE coated	Uniform cover 50

27.7.14 Abbreviations and Notes**27.7.14.1 Notes**

The following items shall be approved by the Engineer:

Hot-dip galvanizing:-	Only for pipes up to 200 mm diameter maximum and flow less than 2 m/s. Pipes shall not be embedded in concrete. Water analysis shall be provided.
Sealant:-	Pipes over 200 mm diameter to be coated with a duplex system. Interfaces of different environments shall be sealed with a Polyurethane or Polysulphide flexible sealant to be applied in accordance with the manufacturer's data sheets.
Un-coated stainless steel:-	Only to be used if no galvanic reaction and anaerobic conditions are present.
Pickle and passivated:-	If not in contact with less noble material. If exposed to anaerobic conditions seal-coat all crevices with Elastoplastic Epoxy. Shall be done by the dipping process.
Galvanic cells:-	Where a galvanic cell is situated within a water path <150 mm and concrete cover <75 mm, the MS, 3Cr12 or SS shall be coated.
Anaerobic conditions:-	SS grade 316L shall be used under anaerobic and aggressive water conditions.
Polyurethane for:-	Re-coatable Polyurethane or Aliphatic Polyurethane where required for colour coding. Only UV resistant Polyurethane shall be used.
Primers:-	Primers shall only be used in special cases i.e. over-coating of galvanized surfaces.

3Cr12:-	In view of superior corrosion resistance, coated 3Cr12 material is preferred.
Mild steel:-	Mild steel may only be used where the pipe lining can be refurbished in-situ.
Items subjected to high temperatures:-	Items to be manufactured out of stainless steel or coated with heat resistant paint.
Epoxy primer:-	Epoxy primer may not be required if appropriate two Pack Epoxy/ Re-coatable Polyurethane or Aliphatic Polyurethane is being used.
Rope dressing:-	Shall be applied using a high pressure impregnation system. Minimum pressure of 5 MPa shall be used.

27.8 REFURBISHMENT

27.8.1 Inspection Procedure

Corrosion damage must be exposed by manual, mechanical or abrasive blast-cleaning for inspection. The refurbishment procedures shall then be specified by the Engineer.

27.8.2 Preparation Methods

- Smooth out all shallow pits with a pencil grinder.
- Weld up and grind to a smooth finish where:
 - More than 25% of the material has been lost by pitting corrosion.
 - Material loss detrimentally affects the strength of the item.
- Replace damaged section.

27.9 SURFACE PREPARATION

27.9.1 Standards

SANS	1344	Medium duty solvent detergent.
SANS	10064	The preparation of surfaces for coating.
ISO	8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
ISO	8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
SANS	5770	Cleanliness of blast-cleaned steel surfaces for painting (freedom of soluble salts).
SANS	5772	Profile of blast-cleaned steel surfaces for painting (profile gauge).
SANS	5769	Cleanliness of blast-cleaned steel surfaces for painting (freedom from dust and debris).
ISO	11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO	11127	Preparation of steel substrates before application of paints – Non-metallic blast-cleaning abrasives.

27.9.2 Responsibility

27.9.2.1 Surface Preparation

- The Subcontractor carrying out the corrosion protection shall be responsible for preparation of all surfaces to be coated.
- On completion of the Contract, all plant, equipment, temporary structures and materials shall be removed from the site.

27.9.2.2 Personnel

- a) The Subcontractor carrying out the surface preparation shall have competent personnel with the necessary technical knowledge of the processes involved.
- b) All work shall be carried out under the supervision of an experienced supervisor.

27.9.2.3 Equipment

- a) Plant and equipment shall, to achieve the specified surface preparation, comply with the following:
 - i) Equipment and air supply free of oil and moisture.
 - ii) Compressors shall have a capacity and pressure output to achieve the required nozzle pressures.
 - iii) Worn nozzles shall be replaced.
- b) If the correct surface preparation is not achieved due to inadequate plant and equipment, the Engineer may order the Contractor to obtain such plant and equipment as may be necessary to achieve the specified results.
- c) All plant, equipment and temporary structures shall at all times be maintained in good and safe working order.

27.9.2.4 Working Conditions

- a) Surface preparation shall not take place when conditions are likely to affect the corrosion protection processes adversely.
- b) The Subcontractor shall provide screens, covers, trestles or any other equipment necessary to avoid contamination of surfaces and to minimise time delays caused by inclement weather.

27.9.2.5 Health and Safety

The Contractor's shall at all times enforce health and safety measures necessary to comply with the relevant Namibian statutory requirements as well as the manufacturer's requirements.

27.9.3 Procedure**27.9.3.1 Approval of Works and Programme**

The Contractor programme, plant and equipment and works shall be approved by the Engineer prior to commencement of surface preparation.

27.9.3.2 Initial Inspection

Before accepting items from the Fabricator, the corrosion protection Subcontractor shall check the initial condition of the surface for:

- Visible surface defects;
- Corrosion or contamination;
- Any required metal dressing;
- Elimination of burrs and radiusing of edges;
- Removing of weld spatter and weld imperfections such as blowholes; and
- Suitable lifting lugs.

27.9.3.3 Degreasing

- a) All surfaces to be coated shall be tested for oil and grease contamination by the water break free test.
- b) Oil and grease contamination shall be removed by:
 - Steam-cleaning.
 - An emulsifiable or aqueous detergent applied in accordance with SANS 1344.
 - An alkaline cleaning solution.
- c) Allow to react, and then rinse off with clean, potable water to remove all residues prior to surface preparation, all in accordance with Clauses 3.3 and 3.4 of SANS 10064.

- d) The surfaces shall be tested after degreasing and show no oil, grease and chemical contamination after degreasing.
- e) Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

27.9.3.4 Rough-Blast

- a) All rust, millscale, old coating or marking paint shall be removed by rough-blasting.
- b) Laminations, scabs and occluded scale which becomes visible after cleaning shall be ground out and the area re-cleaned.
- c) The Engineer shall be advised when blast-cleaning of the appropriate section will be completed so that an inspection can be carried out to determine if repairs are required.
- d) Blast-cleaning shall be done in accordance with the code of practice SANS 10064 to achieve a cleanliness of Sa 2. (ISO 8501-1)
- e) The surfaces to be coated shall be tested for water soluble salts after blast-cleaning. The maximum level of salts allowable on the surfaces shall not exceed the values given in SC 27.9.4.2.
- f) Should these values be exceeded, the surfaces shall be cleaned by:
- g) A liquid soluble salt remover approved by the Engineer or
 - Washing with a high pressure jet of clean potable water or
 - Water injected blast-cleaning or
 - Flash blast-cleaning until the soluble salts are within the specified limits.

27.9.3.5 Final-Blast

- (a) Final Blast
 - Humidity and Temperature

All blast-cleaned surfaces shall be coated within:

Four (4) hours when humidity is below 70% or

Two (2) hours when humidity is between 70% and 85%.

Final-blasting shall not be carried out if the steel temperature is less than 3°C above dew point.
 - Blasting-material

Final blast-cleaning shall be carried out using clean, uncontaminated blast-medium in accordance with SC 27.9.4.2.
 - Cleanliness

All surfaces for "wet/submerged conditions" and for "dry conditions" shall be blast-cleaned to Sa 3 and Sa 2½ respectively.
 - Profile

The required surface profile specified in SC 27.9.4.1 shall be achieved by final-blasting in accordance with SANS 10064 and ISO 8504-2.
 - Residual Dust and Debris

Prior to coating, dust and debris shall be removed by vacuum-cleaning in accordance with SANS 5769. Dust and debris may only be removed by blowing with clean uncontaminated compressed air, with prior approval of the Engineer.

- Contamination

After final-blasting un-coated steel shall not be touched with bare hands. All applicators shall wear white gloves and shoe covers where applicable.

(b) Flash- Blast

Flash blast-cleaning shall be carried out to reinstate the surfaces specified in SC 27.9.4.1, in accordance with SC 27.9.3.5(c).

(c) Sweep-blasting

Sweep blast-cleaning is used to create a fine, even profile on soft materials and to remove portions of a coating.

The parameters for sweep blast-cleaning are as follows:

Equipment and air supply	Free of oil and moisture
Nozzle pressure	Not greater than 300 kPa
Nozzle angle to the surface being cleaned	30 to 60°
Sweeping distance	450 to 600 mm
Abrasive – ultra fine non-metallic grit	Minimum 0.2 mm – maximum 0.8 mm
Grit	Only new grit shall be used

27.9.4 Requirements**27.9.4.1 Surface Conditions**

Prepared surfaces shall be in accordance with the table below:

PROPERTY	FOR DRY CONDITIONS	FOR WET/SUBMERGED CONDITIONS	TAPE WRAPPING
Cleanliness to ISO 8501-1 (min) (SIS 055900)	Sa 2½	Sa 3	Sa 2
Residual dust and debris (SANS 5769)	0.5%	0.3%	0.5%
Oil, grease and perspiration	Nil	Nil	Nil
Surface Profile (min)	30 µm	30 µm	-
Coats up to 200 µm (max)	50 µm	50 µm	-
Surface Profile (min)	50 µm	50 µm	-
Coats up to 300 µm (max)	80 µm	80 µm	-
Surface Profile (min)	60 µm	60 µm	-
Coats up to 500 µm (max)	100 µm	100 µm	-
Water soluble salts: Maximum at any point. Average of any 250 cm.	500 mg/m ² 100 mg/m ²	100 mg/m ² 100 mg/m ²	500 mg/m ² 100 mg/m ²

Note: Surface profile shall be about ⅓ of the coating thickness.

27.9.4.2 Abrasive Material

a) Material

The blast-cleaning abrasive shall be composed of clean, non recycled, sound hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, water soluble salts and foreign metals.

- b) **Certification**
The abrasive material supplier shall certify that all products supplied conform to all the requirements specified.
- c) **Shape and Size**
The individual abrasive particles shall be angular in shape and within the following sizes:
 - Non-metallic material 0.2 to 0.8 mm or 0.4 to 1.4 mm
 - Metallic material 0.3 to 0.9 mm
- d) **Hardness**
The minimum hardness of abrasive material shall be as follows:
 - (a) For non-metallic material – 6 on the Moh's scale
 - (b) For metallic material – 390 HV
- e) **pH**
The pH of the prepared slurry mixture shall not be below 6.2.
- f) **Water Soluble Salts**
The conductivity of slurry shall be less than 25 mS/m in accordance with ISO 11127.
- g) **Moisture Content**
The moisture content for abrasive material shall not exceed 0.2%.
- h) **Re-cycling**
Re-cycled blasting-material shall only be used if:
 - (i) Blasting-materials were only used on degreased surfaces;
 - (ii) Dust and debris is removed from the blasting-material; and
 - (iii) Particles are kept angular and within specified sizes.

27.9.5 Air Supply

- a) The air pressure at the nozzle shall be a minimum of 600 to 700 kPa.
- b) Air supply equipment shall be fitted with efficient oil and water traps to avoid contamination of the surface.

27.10 SURFACE PREPARATION OF OTHER MATERIALS

27.10.1 Corrosion Resistant and Stainless Steel

Components fabricated from stainless steel shall not be contaminated with iron or mild steel.

27.10.1.1 Un-Coated Surfaces

- a) Stainless steel surfaces shall not be contaminated with carbon steel, scratched or stressed.
- b) The following areas shall be pickled and passivated:
 - All un-coated areas.
 - Ground and sheared edges.
 - Heat affected zones caused by welding or cutting.
- c) It is recommended that, if possible, pickling and passivation be done by the dipping process.
- d) Proprietary pickling and passivation chemicals (as supplied by approved suppliers) shall only be used in accordance with the manufacturer's recommendations. Care shall be taken not to exceed the maximum contact time recommended.
- e) After pickling and passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. Surfaces shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer.

27.10.1.2 Surfaces to be coated

- a) **Degreasing**
Surfaces shall be degreased in accordance with SC 27.9.3.3.
- b) **Profile**
- Corrosion resistant steel surfaces shall be blast-cleaned with stainless steel grit or non-metallic abrasive to create a profile in accordance with the table in SC 27.9.4.1. The use of steel shot and steel or cast iron grit is strictly prohibited.
 - Where blasting is impractical, the surface shall be roughened manually with abrasive paper grade 220, disc grinders or flapper wheel abrasive pads. In all instances, clean, uncontaminated equipment must be used.
 - Surface profile shall be in the range of 30 to 50 µm.
- c) **Dust and Debris**
Dust and debris shall be removed by vacuum-cleaning.

27.10.2 Synthetic Materials to be Coated**27.10.2.1 Degreasing**

Surfaces shall be degreased in accordance with SC 27.9.3.3.

27.10.2.2 Profile

Abrade the surface with abrasive paper grade 220 to achieve a uniform matt finish.

27.10.2.3 Dust and Debris

Dust and debris shall be removed by vacuum-cleaning.

27.10.3 Coated Surfaces**27.10.3.1 Primed Surfaces to be Over-coated**

- a) **Degreasing**
Surfaces shall be degreased in accordance with SC 27.9.3.3.
- b) **Profile**
- Primers to be over coated outside the over-coating period shall be abraded with abrasive paper grade 220 to a uniform matt finish.
 - All un-coated areas and all areas with micro rust shall be re-blasted to the original surface finish as specified.
- c) **Dust and Debris**
Dust and debris shall be removed by vacuum-cleaning.

27.10.3.2 Coated Surfaces to be repaired

Spot repairs shall be carried out in accordance with the Specification or as specified by the Engineer. Repairs shall overlap the undamaged area by a minimum of 25 mm. Repairs shall be built up to the original undamaged coating thickness.

- a) **Preparation of Bare Areas**
Bare areas shall be prepared by spot-blasting to Sa 3. If spot-blasting is not possible, clean with abrasive paper grade 220 to a bright metal surface.
- b) **Soluble Salts**
The surfaces shall be tested for water soluble salts in accordance with SC 27.11.2.

27.10.3.3 Feathering of Coated Surfaces

The surrounding paint, which must be intact, shall be feathered for a minimum distance of 25 mm beyond the damaged areas.

- a) Dust and Debris
Dust and debris shall be removed by vacuum-cleaning.

27.10.3.4 Coated Surfaces to be Over Coated

- a) Degreasing
Surfaces shall be cleared of all contamination and degreased in accordance with SC 27.9.3.3.
- b) Profile
Coated surfaces to be over-coated outside the over-coating period shall be abraded with abrasive paper grade 220 to a uniform matt finish.
- c) Dust and Debris
Dust and debris shall be removed by vacuum-cleaning.
- d) Solvent-wiping
- The surfaces to be coated shall be wiped with the solvent specified by the coating manufacturer and approved by the Engineer.
 - Further coats shall then be applied as specified in the Specification.

27.11 TEST METHODS

Tests, instruments, methods and criteria shall be as specified below or in the Specification.

27.11.1 Free of Oil and Grease**27.11.1.1 Wetting with Water**

All surfaces cleaned of oil and grease shall be tested using the "water-break-free" method. The surface shall be wetted with water and the entire surface shall be covered by an unbroken film.

27.11.1.2 Solvent-wiping

Where water soluble lubricants may be present the surface shall be further tested by wiping with a clean cotton wool swab soaked in solvent. No stain shall be evident on the swab after solvent-wiping.

27.11.2 Water Soluble Salt Contaminants

Substrate surfaces shall be tested for the presence of water soluble salt contaminants in accordance with SANS 5770 or by means of the Weber Reilly Test.

27.11.3 Standard of Mechanical Surface Preparation

Mechanical surface preparation shall be visually compared to the standard shown in ISO 8501-1.

27.11.4 Blast Profile

The blast profile of the substrate surfaces shall be determined in accordance with SANS 5772.

27.11.5 Residual Dust and Debris

Substrate surfaces shall be tested for the presence of residual dust and debris in accordance with SANS 5769.

27.11.6 Blasting Material

All blasting-materials shall be approved by the Engineer.

27.11.6.1 Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11125 for particle size, hardness, density, foreign matter and moisture.

27.11.6.2 Non-Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11127 for particle size, hardness, density, moisture and water soluble contaminants.

27.11.7 Protection of Works during Painting Operations

The Contractor shall protect all parts of the structure against disfigurement by spatters, splashes and smirches of paint or of paint materials. The Contractor shall be responsible for any damage, paint or dirt caused by his operations to vehicles, persons or property, including plants and animals, and he will be required to provide protective measures at his expense to prevent such damage.

Any paint stains which may result in any unsightly appearance shall be removed or obliterated by the Contractor at his expense.

If passing traffic creates so much dust that it will harm or spoil the appearance of painted surfaces, the Contractor shall, at his expense, sprinkle the adjacent roads and shoulders with water for a sufficient distance, in order to keep dust away from freshly painted surfaces. The Contractor shall also furnish and post "DRIVE SLOWLY" signs at his own expense and take other necessary precautions to prevent dust and dirt from adhering to freshly painted surfaces.

27.12 EPOXY COATING SYSTEM**27.12.1 Standards**

- a) Equipment, materials and operational methods shall comply with the relevant SANS, ISO, BS, DIN or equivalent American Standard.
- b) The Contractor shall ensure that he is in possession of the latest editions of all the relevant National Specifications, Codes of Practice or Standards referred to in this Specification.
- c) Reference is made to the latest issues of the following Standard Specifications:

SANS	1091	National colour standards for paint.
SANS	1217	The production of painted and powder coated steel pipes.
SANS	5769	Cleanliness of blast-cleaned steel surfaces for painting (dust and debris).
SANS	5772	Profile of blast-cleaned steel surfaces for painting.
SANS	2808	Determination of film thickness.
ISO	8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.
BSS	5493	Protective coating of iron and steel structures against corrosion.
SANS	9000	Model for quality assurance in production and installation.

27.12.2 Material

- a) The Contractor shall have the Manufacturer's data sheets of materials to be used available.
- b) Two Pack Epoxies shall be in accordance with SANS 1217. Solvent free Epoxies shall be used.
- c) Two Pack Epoxies offered shall be polyamine cured.

- d) Multi-purpose Epoxy shall be of the high build, modified aluminium Epoxy mastic type, containing at least 90% solids.
- e) Materials and procedures shall comply with the relevant SANS Specifications and Codes of Practice.
- f) All materials in a coating system shall be purchased from the same manufacturer unless approved by the Engineer.
- g) Details of coating materials to be supplied and approved.
- h) The Contractor shall only proceed with the purchase of coating materials upon receipt of written approval from the Engineer.
- i) Materials offered and subsequently approved shall not be changed without written approval of the Engineer.
- j) Coating material selection shall also be approved by the material manufacturer/supplier. The Contractor shall receive a written assurance from the material suppliers that the materials comply with the specified requirements.
- k) All coating materials shall be delivered in the manufacturer's original containers, clearly marked with the following:
 - Manufacturer's name
 - Product Brand and Reference Number
 - Batch Number which may incorporate the date of manufacture
 - Abbreviated instructions for storage and use of material, which shall include mixing ratios of the components of multi-component materials, minimum and maximum temperature of application and the method of application
 - The SANS mark where applicable.
- l) All coating materials shall be kept in an approved dry and enclosed store. The temperature shall not drop below 0°C nor exceed 40°C.
- m) Usage of materials shall be on a first in, first out basis and no materials shall be used that have exceeded the shelf life recommended by the manufacturer.

27.12.3 Special Coating Areas

- a) Areas that are inaccessible after assembly shall be prepared and fully coated with the specified system to the specified requirements before assembly. The coating shall be fully cured before assembly.
- b) Mating surfaces of joints shall be coated with primer (where specified) or first coat only. The coating shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joints shall be fully coated.
- c) Steel edges to be welded after coating shall not be coated for a distance of 50 mm from the welding edge. The unlined strip of grit blasted surface shall be temporarily protected with a coat of (red or a different colour to the lining/coating) weldable primer between coating application and installation.
- d) Friction grip areas shall be left un-coated unless otherwise specified.

27.12.4 Acceptability of Items to be Coated

Items to be coated shall conform to Sub-Clause 4.1.1 of SANS 1217, with the proviso that "pipes" shall read "items to be coated".

27.12.5 Surface Preparation

- a) The Contractor shall satisfy himself that the condition of each item to be coated is such that it is fit for coating or lining, or both, as relevant. Immediately after surface preparation each item or special shall be examined, including the inside surface, where possible, for compliance with the relevant requirements of this sub-clause.
- b) Pre- and surface preparation shall conform to SC's 20.7 and 27.9 respectively.
- c) For pipes and specials intended for butt welding the prepared surfaces shall extend to the pipe ends.

27.12.6 Coating Thicknesses

Coating thicknesses shall conform to SC 27.7.

27.12.7 Manufacturer's Instructions

- a) Recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead, shall be followed.
- b) The following details shall be made available to the applicator:
 - Brand and type of epoxy resin;
 - Mixing and thinning instructions;
 - Recommended type and quantity of solvent required for thinning during application;
 - Pot life of mixed product;
 - Minimum and maximum recommended dry film thickness per coat;
 - Recommended time intervals between coats;
 - Recommended minimum and maximum steel surface temperatures during application;
 - Time for complete drying and curing on steel surfaces;
 - All relevant information the Supplier wishes to submit on his product; and
 - Recommended method of coating application.
- c) Verbal information by the Manufacturer's representative will not be accepted unless confirmed in writing by the Company.

27.12.8 Coating Application**27.12.8.1 Environmental Conditions**

- a) **Dusty Conditions**
Coatings shall not be applied in dusty or contaminated conditions.
- b) **Surface Temperature**
Coatings shall not be applied if the surface temperature of the steelwork is less than 3°C above dew point or outside the range 5-40°C, unless otherwise specified by the coating manufacturer.
- c) **Relative Humidity and Time of Application**
Refer to SC 27.9.3.5
- d) **Ambient Temperature**
Coatings shall not be applied when the ambient temperature is less than the minimum or greater than the maximum specified by the manufacturer of the coating material.

27.12.8.2 Mixing

- a) The Contractor shall ensure that all paints are mixed in accordance with the requirements of Specification BS 5493.
- b) All coating components, particularly two- or multi-component materials, shall be thoroughly mixed until a homogeneous mixture is achieved.
- c) In the case of two-Pack materials, each component containing pigments shall be thoroughly mixed. The two components shall then be mixed together in the proportions supplied by the Manufacturer until the mixture is completely homogeneous. For two Pack materials, the use of part of the contents (split Packs) is strictly forbidden.
- d) In the case of solvent based Epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period, as recommended by the manufacturer, before use.
- e) During application, coating materials shall be agitated regularly to keep the solids in suspension. The preparation time, induction time and pot life of these materials shall be closely adhered to.

27.12.8.3 Application Requirements

- a) **Equipment**
Application equipment shall be maintained in a clean condition and in good working order.

The use of equipment not maintained in good condition may lead to rejection of the coating.

- b) **Compatibility of Coats**
All primer, intermediate and finishing coats shall be mutually compatible.
- c) **Surface Restoration**
Should immediate lining/coating not be possible, or should any atmospheric oxidation take place between the completion of blast cleaning and commencement of lining/coating, such oxidation shall be removed by flash blasting to restore the specified surface finish. Removal of dust and debris shall be in accordance with SC 27.9.3.5(e).
- d) **Supports**
During coating application, the items shall be so supported to prevent damage to the wet coatings until the coatings have hardened adequately. Items shall remain supported during curing, storing and handling.

27.12.8.4 Method of Application

- a) **Application**
Epoxy coatings shall be applied by any appropriate method recommended by the manufacturer thereof, and approved by the Engineer.
- b) **First Coat**
The first coat shall be applied to a minimum dry film thickness of 40 µm above the peaks of the blast profile.
- c) **Cleanliness**
 - During application and curing of the layers, the items shall be protected against contamination by dust or other foreign matter and shall be kept dry and shaded from direct sunlight.
 - All coats shall be clean and free from dust, oil, moisture and perspiration before over-coating.
 - Operators handling blast-cleaned or partially painted surfaces shall wear clean gloves to avoid contamination of the surface.
- d) **Stripe Coat and Crevices**
 - All metal edges, up stands, welds, bolts and nuts shall be adequately coated. Additional stripe coatings shall be applied after initial priming, if ordered by the Engineer.
 - Special attention shall be given to crevices and edges to ensure complete coverage and uniform paint thickness.
- e) **Second and Subsequent Coats**
The second and subsequent layers shall then be applied within the recommended over-coating periods.

27.12.8.5 Coat Colours

The colour of each subsequent coat shall be different from that of the previous coat except where two finishing coats of the same colour are necessary to achieve colour uniformity.

27.12.8.6 Over-coating Times

Over-coating times shall be not less than the minimum nor greater than the maximum specified by the manufacturer relevant to the ambient temperature.

Strict adherence to over-coating times is particularly important for coatings which are subsequently immersed.

27.12.8.7 Pipe Ends

- a) **Extension of Lining**
For flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for site welding by means of double sleeve weld-on couplings, the lining shall extend to the ends of pipes and specials including edges and shall overlap by at least 300 mm on the outside of the pipe. Coatings shall overlap epoxy surfaces on the outside by at least 25 mm.
- b) **Butt Weld Edges**
For pipes and specials intended for site butt-welding, lining and coating shall extend up to a distance of 50 mm from pipe ends. The unlined circumferential strip of grit blasted surface shall be temporarily protected between the works and Site with a coat of weldable primer (different colour to the lining/coating).

27.12.8.8 In-situ Applied Epoxy Lining

In-situ application shall only be used to make good defects. No welding whatsoever shall be performed on any pipe or special on which the lining or coating has been completed, without the approval in writing of the Engineer. The temporary protected surfaces shall be blast cleaned before coating with the specified system. The approval shall only be considered by the Engineer after submission by the Contractor of acceptable proposals for making good un-coated and damaged areas.

27.12.9 Over-Coating with Polyurethane**27.12.9.1 Wet, Submerged or High Humidity Conditions**

- a) **Re-coatable Aliphatic Polyurethane**
- The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish;
 - The surface shall be vacuum-cleaned to remove dust and debris – refer to SC27.9.3.5(e);
 - Contaminants shall be removed and surfaces prepared by wiping with an organic solvent; and
 - Over-coat with a 25 to 35 µm layer of Re-coatable Aliphatic Polyurethane in accordance with the Colour Code, Annexure 27-2.

27.12.9.2 Dry or UV Conditions

- a) **Re-coatable Polyurethane**
- The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish;
 - The surface shall be vacuum-cleaned to remove dust and debris – refer SC27.9.3.5(e); and
 - Over-coat with a 40 µm minimum layer of Re-coatable Polyurethane in accordance with the Colour Code, Annexure 27-2.

27.12.10 Quality of Coating**27.12.10.1 Finish**

The fully cured coating shall have a uniform, smooth, gloss finish with proper adhesion.

27.12.10.2 Dry Film Thickness (DFT)

The Epoxy coating shall be evenly applied to the minimum final film thickness as specified in SC 27.7 and shall be tested in accordance with SC 27.12.11.

27.12.10.3 Electrical Insulation Defects

All coated surfaces intended for water immersion or where likely to be frequently wetted under normal

service conditions shall show no electrical insulation defects when tested in accordance with SC 27.12.11.

27.12.10.4 Finishing Coat Colours

- a) The finishing coat colours shall be as specified in the Colour Code, Annexure 27-2.
- b) Colours shall be in accordance with SANS 1091.
- c) Where not specified, the selection of final colours shall be approved by the Engineer.

27.12.10.5 Solvent Entrapment

- a) Coatings showing evidence of entrapped solvents after full cure will be rejected. No inter-coat de-lamination shall be allowed.
- b) The Contractor shall be held responsible for blistering of coatings, when shown to be caused by solvent retention.

27.12.11 Testing

To be read in conjunction with SC 27.3.1.

27.12.11.1 Contractor's and Engineer's Inspections

Refer to Section 20 - General Mechanical.

27.12.11.2 Visual Inspection

All surfaces shall be inspected visually and shall be free from tears, runs, sags, wrinkles, blisters, change in colour or gloss, orange peel, dirt, visible pinholes, dust or fluff occlusions or any other visible defects.

27.12.11.3 Holiday Inspection (Electrical Insulation Defects Inspection)

- a) 100% of the lining and coating of all pipes shall be tested and there shall be no electrical insulation defects on any area inspected.
- b) Except for coating containing conductive pigment (Zn, Al), low-voltage wet sponge electrical insulation defects inspection shall be carried out in accordance with SANS 1217 for coatings and linings of thickness not exceeding 500 µm.
- c) For films exceeding 500 µm thickness, the high voltage, sparking electrical insulation defects detector shall be used in accordance with SANS 1217.
- d) Inspection procedure shall ensure that sufficient moisture is present at all times on the surfaces to be tested.

27.12.11.4 Dry Film Thickness (Dft)

- a) Measurements shall be taken in accordance with SANS 2808.
- b) 100% of all coating thicknesses measured shall comply with the minimum requirements of this Specification.
- c) In the case of coats applied after the erection of steel work on Site, the frequency at which measurements of the DFT are taken shall be at the discretion of the Engineer, and may be dictated by accessibility.
- d) DFT in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the paint film is demonstrated to be sound in all respects.
- e) DFT shall be tested within 7 days of application.
- f) DFT measurements taken at times beyond seven days after application shall not constitute a valid claim against the original satisfactory and documented execution of the work.
- g) The method used to measure DFT, and the significance of the readings for each particular item, shall be agreed upon by all parties prior to commencement of the work.

27.12.11.5 Automated Shop Applied Lining and Coating

The film thickness on the first pipe and thereafter on at least one pipe selected at random from every day's production, but not less than one pipe out of every ten pipes, shall be measured non-destructively by an approved eddy current instrument. At least four readings at equally spaced intervals around the circumference, approximately 300 mm from each end of the pipe, shall be taken. The first reading shall be over the weld bead. When practicable an additional four readings at equally spaced intervals around the circumference in the centre of the pipe shall be taken. The thickness shall not be less than the minimum specified over 100% of the area including weld beads. The Engineer may at his discretion supplement the above test by checking wet film thickness on any or all pipes during application of the epoxy resin.

27.12.11.6 Hand and In-situ Applied Lining and Coating

All the applied lining and coating thicknesses shall be tested by means of an approved eddy current or magnetic instrument. At least four readings shall be taken at equally spaced intervals around the pipe circumference at any test point. The first reading shall be over the weld bead. The thickness shall not be less than the minimum specified over 100% of the area including weld beads.

27.12.11.7 Degree of Cure of Two-Component Materials

The degree of cure of a two-component material will vary with time, temperature and ventilation and shall be assessed by solvent wiping in accordance with the method given in SANS 1217 (methyl ethyl ketone resistance test).

27.12.12 Damaged Coatings

- a) All repairs and procedures shall be approved by the Engineer and subject to inspection procedures as set out in SC 27.12.11.
- b) Where the damage is extensive the remedial procedures shall be agreed with the Engineer in writing.
- c) All repairs shall comply with the requirements of the repair-product manufacturer's data sheet. The Engineer may at his discretion request that repaired coating areas undergo adhesion tests.
- d) Any damage occurring during transit from the Contractor's premises to the site shall be the responsibility of the Contractor. The Contractor responsible for installation of equipment at site shall repair any damage occurring on site during handling, assembly, storage, transport and erection.
- e) The repaired area shall be tested in accordance with Sub Clauses 8.4 and 8.12 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.
- f) Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of the Specification.

27.12.12.1 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

- a) Degrease in accordance with SC 27.9.3.3.
- b) Thoroughly abrade the damaged area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper.
- c) Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769 and SC 27.9.3.5(e).
- d) Wipe the abraded paint surface with methyl ethyl ketone and allow to dry.
- e) Apply as many coats of repair material as necessary to achieve the specified thickness and finish.

- NOTE:
1. When solvent borne materials are used, curing time between coats, as specified by the coating material manufacturer, shall be adhered to.
 2. Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

27.12.12.2 Repair Methods for Major Defects

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

- a) Degrease in accordance with SC 27.9.3.3.
- b) Blast-clean all damaged areas to Sa 3 (ISO 8501-1).
- c) Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.
- d) Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769 and SC 27.9.3.5(e).
- e) Wipe only the abraded paint surface with methyl ethyl ketone and allow to dry.
- f) Apply as many coats of repair material as necessary to achieve the specified thickness and finish.

- NOTE:
1. When solvent borne materials are used, curing time between coats, as specified by the coating material manufacturer, shall be adhered to.
 2. Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

27.13 FUSION BONDED EPOXY COATING SYSTEM (HEAVY DUTY)

27.13.1 Standards

- a) Equipment, materials and operational methods shall comply with the relevant SANS, ISO, BS, DIN or equivalent American Standard.
- b) The Contractor shall ensure that he is in possession of the latest editions of all the relevant National Specifications, Codes of Practice or Standards referred to in this Specification.
- c) Reference is made to the latest issues of the following Standard Specifications:

SANS	1217	The production of painted and powder coated steel pipes.
SANS	5769	Cleanliness of blast-cleaned steel surfaces for painting (dust and debris).
SANS	5772	Profile of blast-cleaned steel surfaces for painting.
SANS	2808	Determination of film thickness.
ISO	8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.
BSS	5493	Protective coating of iron and steel structures against corrosion.
SANS ISO	9000	Model for quality assurance in production and installation.

27.13.2 Material

Shall conform to SANS 1217, Type 2, powder coating.

27.13.3 Application

27.13.3.1 Surface Preparation

Pre- and surface preparation shall conform to SC's 20.7 and 27.9 respectively.

27.13.3.2 Coating Thicknesses

Coating thicknesses shall conform to SC 27.7 or as specified in the Specification.

27.13.3.3 Coating Application

- a) Items shall be heated to a temperature of 200°C (only applicable to heavy items) and coated with Fusion-bonded Epoxy by means of an electrostatic powder gun.
- b) The normal procedures pertaining to powder application shall apply.
- c) On completion of the coating, items shall be cured for 60 minutes at 200°C (mean temperature).

27.13.4 Quality of Coating

Refer to SC 27.12.10.1.

27.13.5 Testing

To be read in conjunction with SC 27.3.1 and SANS 1217.

27.13.5.1 Contractor's and Engineer's Inspections

Refer to Section 20 - General Mechanical.

27.13.5.2 Visual Inspection

All surfaces shall be inspected visually and shall be free from tears, runs, sags, wrinkles, blisters, change in colour or gloss, orange peel, dirt, visible pinholes, dust or fluff occlusions or any other visible defects.

27.13.5.3 Holiday Inspection (Electrical Insulation Defects Inspection)

- a) 100% of all coated surfaces shall be tested and there shall be no electrical insulation defects on any area inspected.
- b) Inspection procedure shall ensure that sufficient moisture is present at all times.
- c) For films exceeding 500 µm thickness, a high voltage, electrical insulation defects detector shall be used in accordance with SANS 1217.

27.13.5.4 Film Thickness

- a) Measurements shall be taken in accordance with SANS 2808.
- b) 100% of all coating thicknesses measured shall comply with the minimum requirements of this Specification.
- c) Film thickness in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the coating is demonstrated to be sound in all respects.
- d) The method used to measure film thickness, and the significance of the readings for each particular item, shall be agreed upon by all parties prior to commencement of the work.

27.13.5.5 Degree of Cure of Fusion-Bonded Materials

The degree of cure of fusion-bonded material shall be assessed by solvent wiping in accordance with the method given in SANS 1217 (methyl ethyl ketone resistance test).

27.13.6 Damaged Coatings

- a) All repairs and procedures shall be approved by the Engineer and subject to inspection procedures as set out in SC 27.12.11.
- b) Where the damage is extensive the remedial procedures shall be agreed in writing with the Engineer.
- c) All repairs shall comply with the requirements of the repair-product manufacturer's data sheet. The Engineer may at his discretion request that repaired coating areas undergo adhesion tests.
- d) Any damage occurring during transit from the Contractor's premises to site shall be the responsibility of the Contractor. The Contractor responsible for installation of equipment on site

- shall repair any damage occurring on site during handling, assembly, storage, transport and erection.
- e) The repaired area shall be tested in accordance with Sub-Clauses 8.4 and 8.12 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.
 - f) Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of the Specification.

27.13.7 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

- a) Degrease in accordance with SC 27.9.3.3;
- b) Thoroughly abrade the damaged area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper;
- c) Vacuum-clean the surface to remove dust and debris in accordance with SC 27.9.3.5(e);
- d) Wipe the abraded paint surface with methyl ethyl ketone and allow to dry; and
- e) Apply as many coats of the following repair material as necessary to achieve the specified thickness and finish.
 - Solvent free Epoxy or
 - Fusion-bonded Epoxy powder repair kit.

NOTE: Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

27.13.8 Repair Methods for Major Defects

The total un-coated areas for renovation by the applicator shall not exceed 0.5 percent of the total surface area of a component. Each un-coated area for renovation shall not exceed 2 500 mm². If damaged areas are larger, the items containing such areas shall be re-coated.

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

- a) Degrease in accordance with SC 27.9.3.3.
- b) Blast-clean all damaged areas to Sa 3 (ISO 8501-1).
- c) Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.
- d) Vacuum-clean the surface to remove dust and debris in accordance with SANS 5769 and SC 27.9.3.5(e).
- e) Wipe only the abraded paint surface with methyl ethyl ketone and allow to dry.
- f) Apply as many coats of the following repair material as necessary to achieve the specified thickness and finish.
 - Solvent free Epoxy or
 - Fusion-bonded Epoxy powder repair kit.

NOTE: Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

27.14 GALVANIZING (HEAVY DUTY)

27.14.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 14713	Protection against corrosion of iron and steel in structures - guidelines.
SANS 32	Internal/external protective coatings for steel tubes.
SANS 121	Hot-dip galvanized coatings on fabricated iron and steel articles.
SANS SM 5772	Profile of blast-cleaned steel surfaces for painting.
SANS 2063	Metallic and other inorganic coatings – Thermal spraying.
SANS 2808	Determination of film thickness.

ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.
SANS 10374-1	The suitability of hot-dip galvanized steel piping for the transportation of water.
SANS 1344	Medium duty solvent detergent.
ISO 752	Zinc ingots.
EN 1179	Zinc and zinc alloys – primary zinc.
SANS 9000	Model for quality assurance in production and installation.

27.14.2 Material

- a) The impurities in the molten zinc, as defined in ISO 752 and EN 1179, shall not exceed a total of 1.5%.
- b) Steel to be hot-dip galvanized shall be:
 - i) For aesthetic appearance
 - Aluminium-killed steel or
 - Silicon-killed steel with a Silicon content not exceeding 0.04% and a Phosphorus content not exceeding 0.02%.

NOTE: Material certification shall be supplied.

- ii) For general corrosion protection
 - Aluminium killed steel or
 - Silicon killed steel with a Silicon content not exceeding 0.25% and a Phosphorus content not exceeding 0.02%.
- c) The condition of articles to be hot-dip galvanized shall comply with "Annexure C" of SANS 121.
- d) The condition of tubes to be hot-dip galvanized on a continuous line shall comply with "Annexure A" of SANS 32.

27.14.3 Application

- a) Shall only be done by members of the Hot Dip Galvanizers Association of Southern Africa (HDGASA) in accordance with SANS 9000.
- b) Shall be in accordance with SANS 121 and SANS 32 for tubes.

27.14.4 Tolerances

27.14.4.1 Steel Specials

Shall be in accordance with Clause 6 of SANS 121.

- a) Surface
 - The surfaces shall be free from nodules, blisters, roughness and sharp points. Un-coated areas, flux residues, lumps and zinc ash shall not be permitted.
 - Notwithstanding Clause 6.1 of SANS 121, in the case of handrails etc. a high quality surface finish is required and a bright smooth surface shall be achieved. Only materials specified under SC 10.2 (b) (i) shall be utilised. Double dipping shall not be allowed.
- b) Thickness

The thickness of hot-dip galvanizing shall comply with the requirements of the table below.

Minimum coating thicknesses on items that are not centrifuged.

ARTICLES AND ITS THICKNESS	HEAVY DUTY COATING	LIGHT DUTY COATING	
	Coating thickness μm (min)	Local coating thickness μm (min)	Mean coating thickness μm (min)
Steel ≥ 6 mm	105	70	85
$3.0 \text{ mm} \leq \text{Steel} < 6.0 \text{ mm}$	80	55	70
$1.5 \text{ mm} \leq \text{Steel} < 3.0 \text{ mm}$	65	45	55
Steel < 1.5 mm	55	35	45
Castings ≥ 6.0 mm	105	70	80
Castings < 6.0 mm	-	60	70

Heavy duty coatings are required except in the following cases:

- Where a high surface finish is required.
- Where otherwise specified in this Specification.

27.14.4.2 Steel Tubes

Shall be in accordance with Clause 7 of SANS 32.

- a) Surface
The surface of the coating shall be continuous, smooth and free from flux residues.
- b) Thickness
The thickness shall comply with the requirements of the coating quality A1, in accordance with Clause 8, Table 1 of SANS 32, as specified below.

Minimum local coating thickness requirements for coating quality A1:

Requirements	Coating quality A1
Minimum local coating thickness on the inside surface except at the weld bead	55 μm
Minimum local coating thickness on the inside surface at the weld bead	28 μm
Minimum local coating thickness on the outside surface	55 μm

- c) Adhesion
The coating shall show no evidence of flaking or cracking when tested in accordance with Clause 11.4 of SANS 32.
- d) Coating Qualities
 - Coating qualities shall be A1 for water installations – see Sub-Clause 8.2 of SANS 32.
 - The surface of the coating on the inside shall be as smooth as can be achieved by steam blowing.

27.14.5 Testing

27.14.5.1 Steel Items

To be read in conjunction with SC 27.3.1.

- a) Visual Examination
Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.
- b) Thickness
Thicknesses shall be in accordance with SC 27.14.4.1(b) and shall be tested in accordance with Sub-Clause 6.2 of SANS 121.

27.14.5.2 Steel Tubes

To be read in conjunction with SC 27.3.1.

- a) Visual Examination
Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.
- b) Thickness
Shall be tested in accordance with Sub-Clause 11.3 of SANS 32.
- c) Adhesion
Shall be tested in accordance with Sub-Clause 11.4 of SANS 32.
- d) Chemical Analysis
Shall be tested in accordance with Sub-Clause 11.5 of SANS 32.

27.14.6 Repair Methods**27.14.6.1 Steel Items**

- a) The total un-coated areas for renovation by the galvanizer shall not exceed 0.5% of the total surface area of a component. Each un-coated area for renovation shall not exceed 400 mm². If un-coated areas are larger, the item containing such areas shall be re-galvanized.
- b) The repair method shall be approved by the Engineer before repairs are initiated.
- c) Repairs shall be by zinc thermal spray in accordance with SANS 2063 or three component zinc solvent free Epoxy repair system. The repair shall include removal of any scale, cleaning and any necessary pre-treatment to ensure adhesion – refer to SC 27.9
- d) The coating thickness on the renovated areas shall be a minimum of 30 µm more than the local coating thickness specified in SC 27.14.4.1(b) for the relevant hot-dip galvanized coating unless otherwise specified by the Engineer. The coating on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

27.14.6.2 Steel Tubes

- a) Repairs shall not be allowed on internal surfaces of tubes. Tubes shall be re-galvanized.
- b) Repairs on external surfaces shall be in accordance with SC 27.14.6.1.

27.15 MEASUREMENT AND PAYMENT

No separate payment shall be made for painting and corrosion protection. Payment for the requirements of this Section will be included in the payment item for the particular item supplied including painting or corrosion protection.

ANNEXURE 27-1

NOT USED

ANNEXURE 27-2**COLOUR CODE****MECHANICAL AND GENERAL**

ITEMS	COLOUR	SANS 1091 CODE
Structural steel, Gates	Light grey	G29
Hydraulic power Pack	Strong blue	F11
Hydraulic oil	Salmon pink	A40
Hazardous objects/areas (restricted headroom, crane hook etc)	Golden yellow with black chevron	B49*
Handwheels and levers	Golden yellow	B49
Handrails: vertical	Black	G49
- horizontal	Golden yellow	
Handrails on dam walls - Aluminum	Un-coated	G29
- Stainless steel	Un-coated	
- Galvanized	Light grey	
Floors: - safe and walking areas	Emerald green	E14 B49*
- restricted areas	Golden yellow	
-open flooring (gratings) – MS galvanized	Un-coated	
3Cr12	Un-coated	
Stainless steel	Un-coated	
Fire protection equipment	Signal red	A11*
Control panels	Eau de nil	H43

PUMP STATION

ITEMS	COLOUR	SANS 1091 CODE
Electric motors	Light beige	C57
Pumps/control valves: for raw water	Apple green	H29
for chem-treated water	Middle blue	F07
Fan and coupling guards	Signal red	A11*
Base plates	Black	
Overhead traveling cranes	Golden yellow	B49
Isolating valves: for raw water	Brilliant green	H10
for chem-treated water	Arctic blue	F28

ELECTRICAL

ITEMS	COLOUR	SANS 1091 CODE
Low voltage panels: indoor	Light orange	B26*
outdoor	Light orange	B26
Medium voltage panels: indoor	Admiral grey	G12
outdoor	Admiral grey	G12
Panel accessories (gland plates, back plates, interior)	White	
UPS equipment	Light orange	B26
Transformers	Light stone	C37
LV distribution kiosks, mini subs	Light stone	C37
Standby electrical equipment (Permanently powered)	Signal red	A11*
General outdoor	Light grey green	H40
All equipment – interior	White	

ANNEXURE 27-2 (Continued)**COLOUR CODE****DELIVERY PIPE WORK**

ITEMS	COLOUR	SANS 1091 CODE
Raw sewage	Dark earth	B11
Settled sewage effluent	Brilliant green	H10
Biologically treated sewage effluent	Verdigris green	E22
Final/chlorinated effluent	Eau de nil	H43
Digested sewage sludge	Middle brown	B07
Raw sewage sludge	Dark brown	B03
Humus sludge	Golden brown	B13
Return activated sludge	Golden brown	B13
Waste activated sludge	Middle brown	B15
Supernatants/underflows returning to head of works	Middle buff	B33

NOTE: Colours marked thus * are restricted for specified equipment only.

ANNEXURE 27-3**PRO-FORMA QUALITY CONTROL PLAN FOR
CORROSION PROTECTION**

QUALITY CONTROL PLAN FOR CORROSION PROTECTION							
PROJECT:		SECTION:		QCP NO.		REVISION:	
EQUIPMENT:		FACTORY ID NO.:		COMPILED BY:		DATE:	
DRAWING NO.:		QTY:		CONTACT NO.:		ORDER NO.:	
CLIENT:		CONTACT PERSON:					
CONTRACTOR:		CONTACT PERSON:					
APPLICATOR:		CONTACT PERSON:					
APPROVALS							
CONTRACTOR NAME:		ENGINEER NAME:		DWAF QC NAME:		END USER NAME:	
SIGNATURE:		SIGNATURE:		SIGNATURE:		SIGNATURE:	
DATE:		DATE:		DATE:		DATE:	
LEGEND							
H - HOLD POINT		W - WITNESS POINT		S - SURVEILLANCE		R - REVIEW	
INSPECTION CODE							
1 - APPROVAL		3 - TESTING		5 - REPORT REQUIRED			
2 - MATERIAL CERTIFICATE		4 - VISUAL		6 - RECORD REVIEW			
QUALITY CONTROL							
OPERATION		INSP. CODE	INSPECTION INTERVENTIONS				ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	DWAF QC	END USER	
Documentation approval							
1.1	Quality Control Plan	1					
1.2	Corrosion protection programme	1					
1.3	Coating material	1					Data sheets
1.4	Pickling and passivation material	1					Data sheets
1.5	Rough blast material	1					Data sheets
1.6	Final blast material	1					Data sheets
2 Pre-preparation							
2.1	Dress protrusions and pits	4					Smooth surface
2.2	Radius sharp edges	3					_____mm minimum radius
2.3	Repair blowholes in castings	4					To be approved by Engineer
2.4	Fettle welds	4					Smooth contour
2.5	Remove weld spatter, burrs, laminations, scabs and scale	4					
3 Degreasing							
3.1	Remove oil/grease contamination	3					
4 Rough blast cleaning							
4		4					
5 Measurement of soluble salts							
5.1	Wax at any point	3					Wet surface 100 mg/m ² Dry surface 500 mg/m ²
5.2	Average over 250 cm ²	3					<100 mg/m ² 100 mg/m ²
5.3	Wet cleaning/Re-blasting						Clean soft water
6 Final blast cleaning							
6.1	Blasting material	2					
6.2	Cleanliness: Wet surface	4					Sa
6.3	Cleanliness: Dry surface	4					Sa
6.4	Surface profile	3					50-100 µm

6.5	Residual dust and debris	3					0.3%
7	Application of first coat						
7.1	Dry Film Thickness (DFT)	3					µm
8	Application of second coat						
8.1	Dry Film Thickness (DFT)	3					µm
9	Application of third coat						
9.1	Dry Film Thickness (DFT)	3					µm
10	Completed system						
10.1	Visual appearance	4					
10.2	Dry Film Thickness (DFT) - Wet surface	3					µm minimum
10.3	Dry Film Thickness (DFT) - Dry surface	3					µm minimum
10.4	Dry Film Thickness (DFT) - flange/ mating surfaces	3					µm minimum
10.5	Electrical Insulation Defect	3					Wet surface
10.6	Adhesion test	3					Where required
11	Application of third coat						
11.1	Degreasing	4					
11.2	Pickling	4					
11.3	Passivation	4					

ANNEXURE 27-4

PRO-FORMA COATING APPLICATION RECORD

COATING APPLICATION RECORD																
1. Pre-preparation																
Dress protrusions & pits:																
Radius sharp edges:																
Repair blowholes in castings:																
Fettle welds:																
Remove weld spatter, burrs, laminations, scale & scabs:																
Primary cleaning:																
2. Degreasing																
Material reference										Batch number:						
"Water break free" test																
3. Rough blast cleaning																
Date of rough blast cleaning										Blasting material:						
4. Measurement of soluble salts																
Maximum at any point										mg/m ²		Average over 250 cm ²		mg/m ²		
Maximum at any point – final reading										mg/m ²		Average over 250 cm ² - final reading		mg/m ²		
Wet cleaning/Re-blasting												Blasting material:				
5. Final blast cleaning																
Blasting material:										Cleanliness - wet surface: Sa						
Material certificate No.:										Cleanliness - dry surface: Sa						
Material pH			Hardness scale			Moh's			Residual dust & debris:							
									%							
Surface profile:			Maximum:			µm			Minimum		µm		Average		µm	
Date of final blast cleaning:										Time completed:						
6. Ambient conditions			First coat			Second coat			Third coat			Final coat				
Time			08:00 12:00 16:00			08:00 12:00 16:00			08:00 12:00 16:00			08:00 12:00 16:00				
Rain: Yes/No																
Ambient temperature °C																
Substrate temperature °C																
Relative Humidity %																
Dew point °C																
7. Application of coats			First coat			Second coat			Third coat			Final coat				
Base : Material reference																
: Batch number																
Activator : Material reference																
: Batch number																
Thinner/solvent : Type																
: Batch number																
Application equipment:																
Colour:																
Surface preparation:																
Areas stripe coated:																
Date of application:																
Time application started:																
Time application completed:																
Wet film thickness:																
Wet surface DFT: Min / Ave			µm µm			µm µm			µm µm			µm µm				
No-off readings																
Dry surface DFT: Min / Ave			µm µm			µm µm			µm µm			µm µm				
No-off readings																
Flange/mating surface DFT:Min/Max			µm µm			µm µm			µm µm			µm µm				
No-off readings																
8. Completed system																
Visual appearance:																
Electrical Insulation Defect at V																

Adhesion test:		
Cure test:		
9. Stainless steel – uncoated components		
Degreasing		
Date of degreasing	Material reference:	Batch No.
10. Pickling and passivation		
Date of pickling	Material reference:	Batch No.
Date of passivation:	Material reference:	Batch No.

ANNEXURE 27-5**PRO-FORMA SURFACE PROFILE AND DRY FILM THICKNESS READINGS**

SURFACE PROFILE AND DRY FILM THICKNESS READINGS													
PROJECT:													
EQUIPMENT:													
DRAWING NO.:						QTY:		SECTION:					
CLIENT:						CONTRACT NO.:				ORDER NO.:			
CONTRACTOR:						CONTACT PERSON:							
APPLICATOR:						CONTACT PERSON:							

SURFACE PROFILE

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT FIRST COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT SECOND COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT THIRD COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT FINAL COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE

TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

FLANGE FACES

DATE:

FLANGE SIZE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE

COMMENTS:

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ANNEXURE 27-6**PRO-FORMA TEST CERTIFICATES FOR COATING MATERIALS**

TEST CERTIFICATE FOR SINGLE PACK COATING MATERIAL			
The Manufacturer's test certificate shall contain the following information to be supplied with each batch of product delivered to the Contractor:			
Tender:			
Date:			
Product:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life:			
Volume solids:			
Item	Method	Parameter	Results
Fineness of grind:	SANS 5053		
Viscosity:	SANS 5153		
Mass/l:	SANS 5050		
Non-volatile mass, %:	SANS 5193		
Surface dry:	SANS 5148		
Hard dry:	SANS 5148		
Volume solids:	SANS 3233		

TEST CERTIFICATE FOR TWO-PACK COATING MATERIAL			
The Manufacturer's test certificate shall contain the following information to be supplied with each batch of product delivered to the Contractor:			
Tender:			
Date:			
Product no.:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life - base:			
Shelf life – curing agent:			
Mixed volume solids:			
Mixing ratio (by volume):			
Item	Method	Parameter	Results
Base fineness of grind:	SANS 5153		
Base viscosity:	SANS 5153		
Base mass/l:	SANS 5050		
Curing agent viscosity:	SANS 5153		
Curing agent mass/l:	SANS 5050		
Mixed viscosity after 1/120 of pot life at 20°C:	SANS 5153		
Mixed mass/l:	SANS 5050		
Mixed non-volatile mass, %:	SANS 5193		
Surface dry:	SANS 5148		
Hard dry:	SANS 5148		
Mixed pot life (for 1l of mix):	SANS 5153		
Mixed volume solids:			

THE CONTRACT

PART C3: SCOPE OF WORKS

C3.5 Management

PART C3: SCOPE OF WORKS
 BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
 SUPPLY SCHEME IN CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY, PHASE 1, EMPULUZI
 DAM

C3.5 MANAGEMENT

C3.5.1 Applicable SANS and SABS standards

a) The following SANS 1921 Construction Works standards and associated specification data are applicable:

- i) SANS 1921-1, General
- ii) SANS 1921-2, Accommodation of traffic on public roads occupied by the contractor
- iii) SANS 1921-4, Third party management support
- iv) SANS 1921-5, Earthworks activities which are to be performed by hand
- v) SANS 1921 -6, HIV/AIDS Awareness

The abovementioned South African National Standards make several references to the Specification Data for data, provisions and variations that make these standards applicable to this contract. The Specification Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and these standards.

Each item of Specification Data given below is cross-referenced to the clause in the standard to which it mainly applies.

The associated Specification Data is as follows:

SANS 1921-1, Construction and management requirements for works contracts – Part 1: General engineering and construction works	
Clause	Specification data
Essential data	
4.1.7	There are no requirements for drawings, information and calculations for which the contractor is responsible
4.3.1	Refer to scope of works
4.7.3	No over break allowances for blasting is provided for
4.14.3	Refer to scope of works
4.14.5	The Contractor is required to provide latrine and ablution facilities

SANS 1921-5, Construction and management requirements for works contracts – Part 5: Earthworks activities which are to be performed by hand	
Clause	Specification Data
Essential Data:	
5.1	The depth of trenches which are to be excavated by hand is 1,5 metres

SANS 1921-6, Construction and management requirements for works contracts – Part 6: HIV/AIDS awareness	
4.2.1(a)	A qualified service provider is one that is accredited or a provisionally accredited training service provider in the HIV/AIDS field. A list of accredited service providers can be obtained from the Construction SETA (CETA) (tel 011-265 5900), Health and Welfare SETA (HWSETA) (011-622 6852) or on the Health and Welfare SETA website: www.hwseta.org.za
Additional clauses	
	The duration of each workshop is not to be less than 2 ½ hours.

PART C3: SCOPE OF WORKS
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DAM

C3.5.2 Planning and Programming

The time for completion will be 24 months, which includes the allowance for inclement weather. All statutory holidays for the Civil Engineering Industry falling within the authorised contract period, will be allowed as extensions to this period, but the Contractor will not be paid additional Time-Related charges for these days (Ref. PSA 8.4.1).

The Contractor shall submit to the Engineer within 14 days of the Commencement Date, a detailed programme setting out clearly the sequence of work, and the resources, which he intends to use.

C3.5.3 Environment

a) Sand and dust control

The Contractor shall, for the duration of the contract, take appropriate measures to control the dust and soil movement, which may arise due to his operations.

b) Precautions Against Nuisance

Operations are being conducted in an urban area and in the presence of passing traffic. Precautions shall be taken to protect the public and to prevent unnecessary noise, dust or other nuisance.

Any rock or debris falling from trucks on the roads in use by the public shall be removed immediately. Precautions shall be taken to prevent fouling of public roads and completed construction by trucks transporting muddy material. The Engineer may order the Contractor to broom off and clean roads continuously where the mud tracking of vehicles or falling debris may constitute a danger to the travelling public.

c) Silencing of Plant

Plant used on the Works shall be efficiently silenced and comply with the Noise Control By-Laws as appeared in the Administrator's Notice No. 1784 of 29 November 1978. Noise operations will be permitted only between the hours of 7:00 am and 5:00 p.m. Any work outside normal hours will be permitted only on the written authority of the Engineer, laid down in Clause 26 of the General Conditions of Contract.

C3.5.4 Accommodation of Traffic On Public Roads Occupied By The Contractor

The works involves the construction of new roadways and stormwater within an established residential community. The works will be undertaken in such a manner to provide access to residential property accesses and special attention must be drawn to the accommodation/deviation of traffic on the affected area of the works.

The need to accommodate the traffic safely and with the least amount of inconvenience to the travelling public is necessary throughout the construction period. 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.

Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the Engineer to stop the execution of the works until the road signs, etc, have been repaired to his satisfaction. The Contractor may not commence constructional activities before adequate provision has been made to accommodate traffic in accordance with the specifications.

PART C3: SCOPE OF WORKS
BID No: ALMT 14/2025 - THE CONSTRUCTION OF EMPULUZI/METHULA BULK WATER
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C3.5.5 Testing, Completion, Commissioning, and Correction of Defects

Materials of work that do not conform to the approved samples submitted in terms of the General Conditions of Contract will be rejected. The Engineer reserves the right to submit samples to tests, to ensure that the material represented by the samples meet the specification requirements.

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the specifications and drawings rests with the Contractor, and the Contractor shall at his own expense, institute a quality control system and provide experienced engineers, foremen, surveyors, material technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

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

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

On completion and submission of every part of the work to the Engineer for examination, the Contractor shall furnish the Engineer with the results of the relevant tests to indicate compliance with the specifications.

C3.5.6 Recording Of Weather

Daily temperature and rainfall data shall be recorded in the site diary, and a copy shall be provided to the engineer's representative on a weekly basis. A rainfall gauge shall be located at the contractor's site camp. Temperature readings shall be taken at commencement and closure of the site on a daily basis. Additional readings will be required during construction of layer works, concrete works and surfacing.

C3.5.7 Format of Communications

Communication throughout the contract will be undertaken via written communication either by fax, site instruction or post. Email communication will only be considered as proof of communication when followed up by a written communication on the letterheads of the author or via a site instruction.

Request for inspection of the works will be accepted telephonically, however this request must be recorded in the site diary and site instruction book.

C3.5.8 Key Personnel

A schedule of key personnel to be employed with curriculum vitae of relevant experience shall be provided to the employers' representative prior to site handover.

C3.5.9 Management Meeting

The Engineer will conduct site meetings, prepare and circulate minutes, as determined by him at the beginning of the contract. The Contractor shall attend these meetings and shall ensure that when necessary, the required sub-contractor is represented. The approved minutes shall become part of the contract documents.

The Contractor shall be required to conduct safety meetings at intervals agreed to between the Employer or his Safety Agent and the Contractor as specified in the Health and Safety Specification bound in this document.

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C3.5.10 Payment Certificates

The contractor shall submit to the engineer after the end of each month a statement in the required format, showing the estimated amount due to him, calculated in accordance with the General Conditions of Contract. The statement to be submitted by the contractor shall consist of 2 copies of the schedule of quantities.

C3.5.11 Protection of the Public

The Contractor shall at all times ensure that his operations do not endanger any member of the public. As the area is adjacent to a residential area the Contractor shall take special precautions to prevent public access to any danger areas on the Works, e.g. by temporary barricades and/or fencing.

C3.5.12 Site Visitors Book

A Site Visitors Book must be kept on site. All visitors visiting to the site must report to the site office and sign in the Site Visitors book before entering the construction site. The Agent and/or the Safety Officer must always accompany the Visitor. The Visitor must wear a hard hat, safety shoes and safety clothing when required.

C3.5.13 Information In Respect Of Plant

Information relating to plant on Site shall be recorded in the Daily Site Diary. In addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of construction plant kept on the Site, full particulars given for each day of the month. Distinction shall be made between plant in working order and plant out-of-order. Such inventory shall be submitted by the first day of the month following the month to be reported.

C3.5.14 Information in Respect Of Employees

Information relating to labour and management on Site shall be recorded in the Daily Site Diary, in addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of supervisory staff, labour employed (own and local labour) by category, and sub-contractors (both local and imported) for each day of the month. Such return shall be submitted by the first day of the month following the month to be reported.